

CHEMISTRY

CLASS-XII

STRICTLY ACCORDING TO THE NEW SYLLABUS INDIA'S FIRST SMART BOOK



PART-I & II

Dr. S.P. Jauhar

According to new syllabus prescribed by Central Board of Secondary Education (CBSE), New Delhi and State Boards of Uttarakhand, Kamataka (IInd Year PUC), Chhattisgarh, Jharkhand, Punjab, Haryana, Himachat, Kerala, Mizoram, Meghalaya, Nagaland, Assam, Manipur and other States following CBSE & ISC cumculum.

MODERN'S

CHEMISTRY

INDIA'S FIRST SMART BOOK

Strictly
in accordance
with the Latest
ouldelines and Syllabus
issued by
N.C.E.R.T. / C.B.S.E.

For Class XII
PART-II

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HALOALKANES AND HALOARENES

OT PERMANENTS AS Preparing for Competition. Building on.... Assessing.... · Quick Memory Test unth Understanding Texts Additional Useful Information 118 107 Topicwise MCQs 120 Anarouert Conceptual Questions 81 Competitive Exactionation Quality HOTS & Advanced Level CHAPTER SUMMARY & QUICK - AIPMT & Other State Boards' 109 Questions with Answer CHAPTER ROUND UP 85 Medical Entrance 193 JEE (Main) & Other State REVISION EXERCISES Boards Engineering Entrance 196 NOERT FILE (with Previous Years' GBSE Ge. > JEE (Advance) for IIT Entrence & Other State Boards (9s) 111 · In-text 95 & Exercises with 140 · Hints & Answers for Revision Solutione NCERT Ensurpler Problems 117 Exermene (Objective Questions) 144 NCERT Exemplar Problems with · Hints & Explanations for Answere & Solutions (Subjective) 102 UNIT PRACTICE PEST 165 Difficult Questions 151

The replacement of one or more hydrogen atoms of a hydrocarbon, aliphatic or aromatic, by an equal number of halogen atoms results in the formation of haloalkanes (or alkyl halides) and haloarenes (or aryl halides) respectively.

Haloakane: RX where R is alkyl group

Halnarene : ArX where As is arene. X is halogen atom (F, Cl. Br, I)

Thus, haloalkanes and haloarenes are halogen derivatives of aliphatic and aromatic hydrocarbons.

Haloalkanes contain halogen atom (s) attached to the sp^3 hybridised carbon atom(s) of an alkyl group whereas haloarenes contain halogen atom(s) attached to sp^3 hybridised carbon atom(s) of anyl group.

These classes of compounds find wide applications in Industry as well as in our day-to-day life. Some naturally occurring halogen containing organic compounds are important in health care and medicine. Some synthetic organic halogen compounds are also clinically useful. For example, chloroquine is used for the treatment of malaria and halothane (CF₃CHClBr) is used in surgery as an anaesthetic. In modern electronics industry, halogenated solvents such as trichloroethylene are used for cleaning semiconductors, chips and other components.

Above all, these organic halogen compounds are used as important starting materials for the synthesis of a wide range of other substances.

or 1-Bromo-4-methylbenzene

CLASSIFICATION OF HALOGEN DERIVATIVES OF HYDROCARBONS

The halogen derivatives of hydrocarbons are broadly classified into two simple types :

- 1. Aliphotic halogen compounds
- 2. Aromatic halogen compounds

1, Aliphutic halogen compounds

These are the compounds which are obtained by the replacement of one or more hydrogen atoms of an aliphatic hydrocarbon by an equal number of halogen atoms. These can be further classified on the basis of the nature of aliphatic hydrocarbon, whether alkanes, alkenes or alkynes as haloalkanes, haloalkenes or haloalkynes, respectively.

(i) Halonlanes: The halogen derivatives of alkanes are called halonihanes. These are also called nikyl-balides. These are formed by replacing one hydrogen atom in alkane by a halogen.

$$R = H$$
 $\xrightarrow{-H}$
 $R = X$
Haloalkane or alkyl halide
 CH_4
 $\xrightarrow{-H}$
 CH_3Cl
Chloromethane or methyl chloride

The general formula of haloalkanes or alkyl halides is C_nH_{2n+1} X or commonly written as RX where R is an alkyl group and X is a halogen atom (F, Cl, Br or I) and $n = 1, 2, 3 \dots$.

Some common examples are :

GH _a Cl	CH ₃ CH ₂ Br	CH ₂ CH ₂ CH ₂ C1	CH ₂ CH ₂ I
Chloromethane	Bromeethane	Chloropropana	Inductione
(Methyl chloride)	(Ethyl bromide)	(n.Propyl chloride)	(Ethyl rodide)

NOTE

e.g.,

Whenever, two names are given under the formula, the name outside the brackets refers to IUPAC name and the name given in the brackets refers to the common name.

The compounds are also known in which more than one hydrogen atoms of the alkane molecule have been replaced by halogen atoms. These compounds are called polyhalogen derivatives of alkanes or polyhaloalkanes.

(ii) Halonikenes or alkenyl halides. The halogen derivatives of alhenes are called haloalkenes or alkenyl halides. The monohalogen derivatives of alkenes have the general formula $C_nH_{2n-1}X$ where X=F, Cl, Br or I. For example,

(iii) Haloalkynes or alkynyl halides. These are the halogen derivatives of alleynes. The monohalogen derivatives of alkynes have the general formula $C_nH_{2n-n}X$, where X=F, Cl, Br or l. For example,

H—C=C—Cl
$$\overset{3}{\text{CH}_3}$$
— $\overset{2}{\text{C}}\equiv\overset{1}{\text{C}}$ —Br $\overset{3}{\text{Br}}$ — $\overset{3}{\text{CH}_2}$ — $\overset{1}{\text{C}}$ — $\overset{1}{\text{CH}}$

Chlorosthyne 1-Bromoprop-1-yne (Propergyl bromide)

2. Aromotic halogen compounds

These are the compounds which are obtained by the replacement of one or more hydrogen atoms of aromatic hydrocarbons by an equal number of halogen atoms. These are of two types :

(i) Nuclear halogen derivatives. These are the halogen derivatives of aromatic hydrocarbons which are derived by replacing hydrogen atom attached to the benzene ring by a halogen atom. These are also called haloarenes or aryl halides. Therefore, in haloarenes, the halogen atom (F, Cl, Br or I) is directly bonded to the aromatic (benzene) ring. For example,

The aryl halides are commonly written as Ar-X, where Ar (short name for aryl) represents a phenyl group.

or 1-lode-2-methylbenzene

(ii) Side chain halogen derivatives. These are the derivatives of aromatic hydrocarbons in which one or more atoms of the alkyl side chain of a benzene are replaced by the halogen atoms. These compounds are not regarded as anyl halides because halogen is not directly attached to the benzene ring. These are called side chain substituted anyl halides or aralkyl halides. For example,

CHCL

CCI

Čalcala.

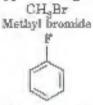
aralkyl balidee

1-Chketa-1-phonylmethane (Benzyl chloride) 1, 1 Dichioro-1-phenylmethane (Benzal dichloride) 1, 1, 1-Trichlore-1-phonytmethane (Reazo trichlorida) 1-Brome-3-phenylettene (β-phenyletty/ brounds)

These haloalkanes or haloarenes may be simply classified on the basis of the type of halogen atom present, the number of halogen atoms and the nature of carbon arom to which the halogen is attached.

A. Type of balogen atom.

The belogen derivatives of hydrocarbons may be classified as fluoro, chloro, brome and iode compounds depending upon the type of halogen present. For example,



Ethyl chloride Ol

CH, CH, CL

CH,CH,I Ethyl iodide Br



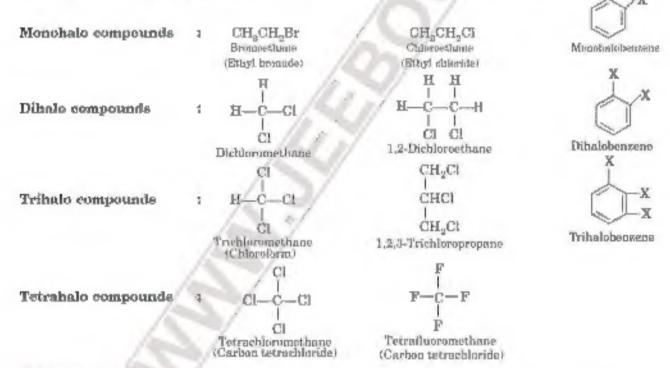
Filliminbetskeine

Cidorotecinene Evanobernane

Todobermene

B. Number of halogen atoms

The halogen derivatives of hydrocarbons may be classified as mono, di, tri ... halo compounds depending upon whether they contain one, two, three,... halogen atoms in their molecules. For example,



C. Nature of carbon atom

Halonikanes are classified as primary (1°), secondary (2°) or tertiory (3°) depending upon the nature of carbon atom to which the halogen is attached.

- (i) Primary haloalkanes are those which have one or none alkyl group on the carbon bonded to the halogen atom.
- (ii) Revendory balantkanes are those which have two albyl givings on the carbon bonded to the halogen atom
- (iii) Tertiary haloalkanes are those which have three alkyl groups on the carbon bonded to the halogen atom.

Classification on the basis of type of hybridization of earbon bonded to the halogen atom

The monopholo compounds may further be classified according to the type of hybridization of the carbon atom bonded to the halogen atom.

1. Compounds containing sp^3 hybridised carbon $[C(sp^3) - X]$

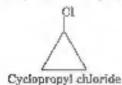
These compounds contain sp^2 hybridised carbon atom bonded to a halogen atom (X = F, Cl, Br, I). These are of the following types:

(a) Halcalkanes or alkyl balides (RX). In these halides, the halogen atom (X) is bonded to an alkyl group (R). These form homologous series of compounds represented by C. Hannik. For example,

> CH, CI Chloromediane (Methyl chloride)

CH,CH,I Iodocthane (Ethyl sodide) CH, CH, CH, Br 1-Bromopropane (Propyl bromide)

If R is alicyclic in R-X, the halide is called cyclo alkyl halide or halocyclo alkane, which may be secondary or tertiary. For example,



Cyclohexyl bromide



Cyclopentyl iodide



1-Bromn-1-methylcyclohexane

(b) Allylic halides. In these halides, the halogen is bonded to an ap' hybridized carbon atom next to a carbon-carbon double bund. The carbon atom next to carbon-carbon double bond is called allylic carbon and therefore, these are called allylic halides. For example,

$$\overset{1}{\text{CH}}_2 = \overset{2}{\text{CH}} - \overset{3}{\text{CH}}_2 - \overset{3}{\text{CH}}_2$$

S-Haloprop-1-ene (1") S-Chloroprop-1-ene (1") (Allyl balide)

4-Brumopent-2-ene (10°)

3-Chlorocyclohex-1-ene 3-Chloro-3-methylcyclo

(c) Henrylia halides. In these halides the halogen stom is handed to an eps hybridised carbon stom next to an aromatic ring i.e., to a benzylic carbon. For example,



CH.Br

CH,CI

Helophenylmethane (Benzyl balide) (1") Bromophenylmethane Chlorophenyl methane

1-Bromo-1,2,3.4-tetra hydronaphthalena (2°) 2-Halo-2-phenylpropane (3°)

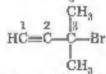
It may be noted that allylic and benzylic halides may be primary (1°), secondary (2°) or tertiary (3°).

(d) Propargyl balides. In these habites, the balogen stam is bonded to a sp⁹ hybridised carbon atom next to a carbon-carbon triple bond.

5-Bromoprop-1-yne (Propargyl bromide)



3 Chiorobut-1-yne



3-Bromo-3-methy but-1-yne

Compounds containing sp² hybridised earbon [C(sp²)-X].

These halogen derivatives of hydrocarbons contain sp^2 hybridised carbon. In these compounds, halogen is directly bonded to one of the carbon atoms of a double bond (-C=C—X). These include :

(a) Vinylic halides. In these halides the halogen atom is bonded to an sp2 hybridised carbon of one of the carbon atoms of a double band i.e. vinylic carbon. For example,



CH_=CH_CL

Chlcroethene

I-Halocyclohex-1-ene

Halaetheue (Vinyl chloride) (Vinyl balide)

(b) Aryl balides. In these balides, the balogen atom is bonded to a sp² hybridised carbon of an aromatic ring.

For example,

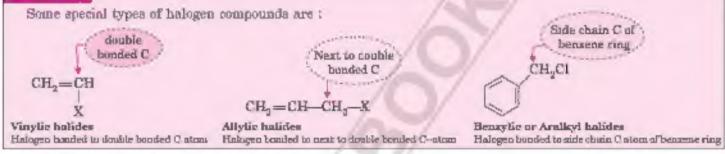
These aromatic balogen compounds are also called helourenes.

3. Compounds containing ap hybridised carbon [C(sp) - X]

These halogen derivatives of hydrocarbons contain sp hybridised carbon. In these halogen derivatives, halogen is directly bonded to one of the carbon atoms of a triple bond (-C = C - X). For exemple,

$$HC = C - CI$$
 $CH_0 - C = C - C$ $Chloroothyne$ $Chloropropyne$





Let us discuss the shometry of alicyl buildes and anyl halides.

NOMENCLATURE OF HALOALKANES AND HALOARENES

Naming haloalkanes (or alkyl halides)

Monohalogen derivatives

Common Names: In the common or trivial system the monohalogen derivatives of alkanes are called **nikyl** halides. These are named by naming the oldy's group attached to halogen and adding the name of the halide. For example,

The name of the alkyl and halide is always written as two separate words. The prefixes n-, iso-, sec-, lert-, etc. used for the alkyl group are also written.

▶ It may be noted that sec- or text- compounds are written with a deah between sec- or text- and the name of the alkyl group. For example, text-butyl, etc. However, the iso-or neo-compounds are written as one word. For example, isobutane, neopentane, etc.

REMEMBER

The prefixes n-, isc-, neo- are used for the following alkyl groups :

The prefix n-is used for alkyl group having continuous chain of C-atoms with no branching.

The prefix iso-is used for those alkyl groups in which one methyl group is attached to the next to end C-stom.

The prafix nec- is used for those alkyl groups which have two methyl groups attached to the next to end C-stem. HIPAC names: In the IUPAC system, the monohologen derivatives of alkanes are named as haloulkanes. The names are written by prefixing the word halo to the name of the alkane corresponding to longest continuous carbon chain holding the halogen atom. In case of branched chain alkanes, the following rules are followed:

- (i) Select the longest continuous chain containing the carbon attached to the balogen group and name it as the parent chain. If a double or triple bond is present, the parent chain must contain it.
- (ii) Number the carbon atoms of the parent chain, beginning from the end nearer to the first substituent, regardless of whether it is alkyl or halo group.
- (iii) If two or more substituents are present on the parent chain, these are named in the alphabetical order alongwith their appropriate positions.
 - It may be noted that di, tri, tetra etc. are not considered while comparing the substituents for alphabetizing purpose. For example,

5-Chloro-2, 4-dimethylheptane

2-Bromo-4, 6-dimethylheptane

(iv) If two different substituents are present at equivalent positions from the two ends of the chain, then numbering the chain is done in such a way that the substituent which comes first in the alphabetical order twritten first in the name) gets lower number. For example,

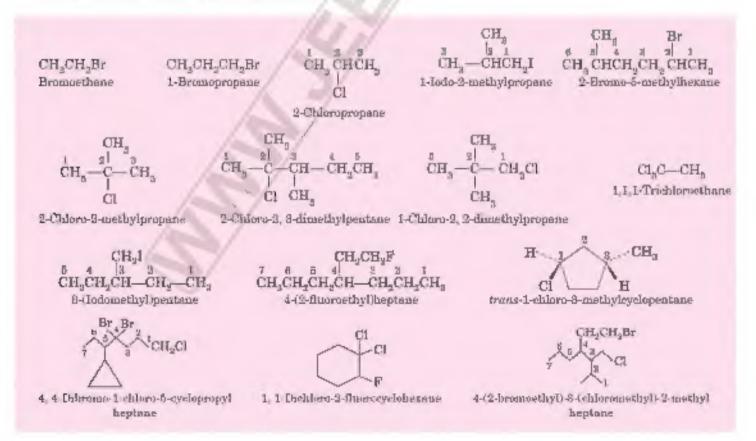
(Nut 6-Ethyl-3-iodohaptane)

CH₂CHCH₂CH₂CHCH₃CHCH₄

2-Bromo-5-methylhexane (Not 5-Bromo-2-methylhexane)

[For more rules see Appendix A]

To illustrate the rules, some examples are given below:



The common and IUPAC names of a few alkyl another are given below

Alkyl halide	Common name	IUPAC name
CH2GI	Methyl chloride	Chloromethana
$CH_{q}CH_{c}Br$	Ethy) brounde	Bromoethane
CH ₃ CH ₂ CH ₂ F	a Propyl fluorale	» Fluoropropane
CH_CHI	Isopropyt todase	2-Iodopropane
ĆH _a		
CH ² CH ² CH ² CI	a-Butyl chlorida	1-Chlorobutane
"H _a s H "Hat"H _a	sec Butyl clusomae	2-Maturobasche
N		
CH ₃ CHCH ₂ Cl	Isolrutyl chlande	1-Cluaro-2-methylpropane
CH ₃		
CH _a		
СН₁—О—СН₁	tert-Butyl chloride	9-Chloro-2-methylpropane
çı	as a many continue	a-managaropane
CH _a : -CH _a CH _a CH _a CH _a Ct	n-Pentyl chloride or	1-Chloropentane
	4 Amvi chamde	
Harrier Harry	reopenty chloride or Leoency) chloride	. Chlom-3-me+hylbutane
CH"		
	and the state of t	
CH¹ € CH¹CH¹	tert Pentyl chloride or fert-Amyl chloride	2-Chioro 2-methylbutane
GL CH,		
Ott ₉		
CH, C CH,C	Neoperty alloyade or	r-Clutter-2,2-dimentylproperse
CH ₅	Neoamyl chlorada	

NOTE

Amyl is community used for 2.4 — group. The prefixes as a random written as non-hyphenoted prefixes while a see or tert-are written as hyphenoted prefixes.

Dibulo and polybalo derivatives

The dualor letters are special common names depending apon whether the hangen atoms are present in the same or different carbon atoms. These are commonly named according to IUFAC system.

When noth the haloger atoms are attached to the same C-atom, these are called **gem-dihalides.** These are also called **nikylidene dihalides** or simply **alkylidene halides**. For example



gem dihaada | IUPAC | 1 Dichloroethane | IUPAC | 2, 2-Dichloropropone | IUPAC | 1 | Dichloropropone

n) When the two halogen atoms are in adjacent C-atoms, they are called vicinal dihalides or simply vio-dihalides. These are named as the dihalide of alkene from which they may be prepared by the addition of halogen atoms in a alkylene dihalide or singly alkylene halide. For example.

vicinal dibalide

TUPAC 1 2-Dichlomethane

IUPAC 1. 2-Dichloropropane

RTPAC : 2-Dilicona-2methylogopane

Polymethylene dihalides. When the same two halogen atoms are present on the terminal carbon atoms e α, α positions of the carbon chain, they are called **polymethylene dihalides**. For example,

BrCH,CH,CH,Br

CICH, CH, CH, CH, CH, CI

KINCH THICHICHI

Tranethylene dataonade

Tetramethylene dichionde

Poutametaylene duodide

RPAC 1.8 Dibromopropane

TPAL 4 Dichiorobutane

I PAt . 5-Dandopertane

Polyhologen derivatives are named according to IUPAC system.

Tribalomethanes and tetrahalomethanes are named as haloforms and ourse adometh; nes respectively

CHCl₃
Chloroform
Trichtoromethene

CHI_p

redeform

Impodemethane

Carbon tetrachionde Tetrachioromethane

Fully halogenated hydrocarbons are also called **perhalohydrocarbons** per means that all the hydrogens of the hydrocarbons are replaced by halogen atoms. It may be noted that polyhalosikanes and other complex halogen compounds are named according to IUPAC system.

(CF_s—CF_z—CF_s) Perfluoropropane

IUPAC . Octafluoropropane

It may be noted that the name of the and polyhalmakungs containing different halogen along are written by prefixing the name of each halogen along in my larger alongwith its arms to the name of the parent alkane. The lowest locant being given so that halogen along which comes first in alphabetical order provided it does not motate the lowest locant our rule. For example,

CICH HOHBE

Brith THI O'CH TICH,
ABronce -declaror butters

CICH, CH-DCH-CH-CH-Br
5-Brown-1-chioro-2-odopentane
Not I-Brown-4-indo-5-chloropeniane

HELP

The compound CICH₂CH(ICH₂) H₂CH₃Br counct be nemed a Brown-4-sodo-6-champentage because it violated lowest set of social rule

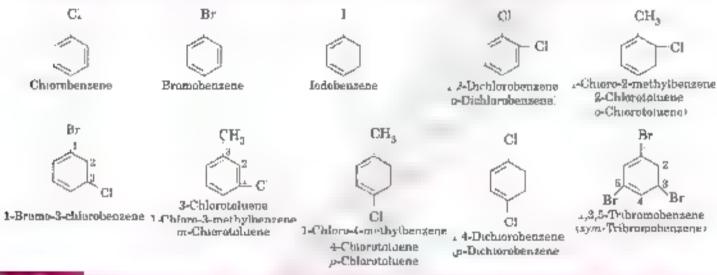
Some of these are given in Table 1

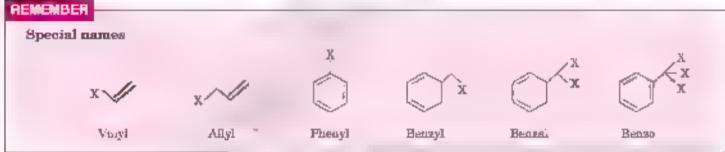
Table 1. Common names and U.PAC names of puls halvalisations and complex halogen comprunds.

Structure	Common name	IUPAC name
OH _e Ol ₉	Medgylene chlomde	Ibelilarometanne
CH ₂ = CHC!	Vinyl chloride	Chloroethens
CH ₂ = CHCH, Hr *	Allyl brounds	1-Влоширгорама
ÇH₅− ÇH₃	Ethylene chromde	1.2 [heblomethnon
CE CI		
CH,CHCL	Ethylidene duoride	Dichloroethane
riting	Ohi mafaran	Techloremethane
JHL	_odoform	Tritodomethane
OHB _r	Вистобори.	Tribromomethane
CH.,Br		
	Benzyl brimide	. Brome 1-phenylmethens
	nearly principle	1 -0/0mm 1 poettymentone

Naming hologrenes or aryl balides)

However it any mances are named by adding the prefix ratio (fluoro, which through the name of the aromatic hydrocarbon. In case of disabstituted compounds, the relative positions of the substitutents 1/2 - 1, 8 and 1, 4 are indicated by the prefixes or to a = mcin a =





ISOMERISM IN HALOAGRANES AND HALOARENES

Haloalkanes show two types of tsamertams

1. Chain isomerism. The radon kanes containing four or those carbon atoms exhibit chain isomerism in which the somers differ in the chain of carbon atoms. For example, C_2H_0 Br has three chain isomers as

2. Position isomerism. The halos kanes containing three or more carbon atoms exhibit position, somerism in which the isomers differ in the position of halogen atom. For example, C_4H_4I has two position isomers

Halvarenes also show position momentum as

...2-Dichlorobensens (o-Dichlorobensens)

I.4-Dichterobenione p-Dichterobenione

SOLVED EXAMPLES

□ Example 1...

Write IUPAC names of the following compounds

1) CH₂—CH—CH₂—CH—CH₂ (D.S.B. 2010)

co (CHCB₈)

Br .s BrCH,CHCICHCL,

Solution

3-Bruno-5-chloro-3, 5-dimethylheptane

2-Chloromethyl, 1 ... dannethylovolopentane

4-Chioropeut 1-eme

4-(1 Brancethyl)-3-chloro-2-2, 7-brimethyloctane

 $CH = C \quad CH_1Br \qquad (D.S.R. 2012)$

OCH.

$$CH_3$$
 $CH_3 - CH_2 - Br$
 CH_4

. Brano-3,9-dimethylpropane

. Brauc-2-indocyclobutene

$$CH_1 = \overset{2}{C} - \overset{3}{C}H_3Br$$

CH₀ 3-Bromo-2-methylorogene

a Chloru-S-methogycyclopentone

3 Bramo : 12-truthlerograpane

2-Brance-4-chloropeotage

Example 2.

Write IUPAC names of the following compounds

$$\stackrel{H}{\longrightarrow} \stackrel{H_3C}{\longrightarrow} \stackrel$$

Splution

.
$$\tilde{C}H_2 = \frac{3}{C} \quad \overset{3}{C}H + Br \quad 3 \cdot Bromo \cdot 2 \cdot methylbuc \cdot 1 \cdot ene$$

$$\overset{H}{C}H_3 = 34,$$

Example 3.___

Write the structures of the following compounds:

2 Chiaro-3 methylpentane.

C'idon-4-ethylografierane in: 4 test Butyl 3-radateplane

I Bromo + sec-butyl ?-nrethychenzene

N.C E.R.T.

Segution

(iii) 1, 4-Dibromobut-2-ana Br
$$\overset{1}{\text{CH}}_2$$
 $\overset{2}{\text{CH}}$ $\overset{2}{\text{CH}}$ $\overset{2}{\text{CH}}$ $\overset{4}{\text{CH}}_2$ Br

to. 1-Bromo-4-sec-butyl-2-mathylbenzone

Example 4.

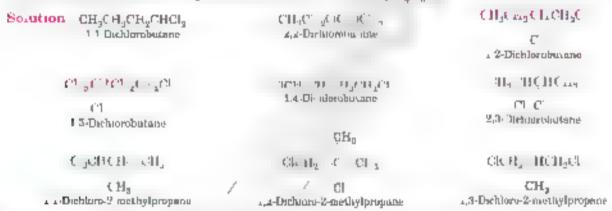
Draw the structures of all the eight structures -somers that have the motecular formula $\epsilon_B H_{sp} Br$ Name each -somer according to the r HPAC system and classify them as primary, secondary or tertiary N.C K.R.T.

Solution Eight isomers are possible. CH, CCHCH, Br CH₁C₁₂Ch₂ Ch₃ C₁₃ H₄ CH, CH, CH, CH CH, CH₂CH₂CH₂CH₃CH₃Br 1 Emminpostano 1º Br Brome-S-mothylbusane .** П÷ 9-Broniopentalie 3 2- Broroopentane 2° CH. Br Clay CCH, Br CH,

CH. Ha I Bromo-2-math-ributane In 2 Bromo-3-methylbutana [2] 2-Brunto-2-methylbutane (f) 4 - Republic 2: a-thiniethylpropone 4

Example 5...

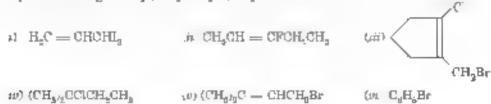
Write structural formulae and give H PAC names of isomers of $CH_{\sigma}Ci_{\sigma}$



- Five the structural formula and "Life" names of a uso-butyl todade & tert-amyl bromide a ter-butyl bromide
- Write the structures of the following compounds and identify them as 1° 2° or 5° habdes.
- - a 1 Bromo-2-methylpropone h 24 hloro-2-mathylpropane 2-Bromo-3-methy, butane d a-Bromopentane
 - / Neopenty-chlumde e 2-Bromo-2-methylbutene
- Write the structures of the following dibelon knows and identify them as gettion or ments. Jany
- a) 2, 3-Dichlumbuhune 612, 2 Dichlorobutana (c. 1, 4-Dichlarobutane
 - (d) 1 2-Dichiorobutane / (a) 1. 9-Dichloro-9-methylpropane
- Write all the possible samers of compound C₄H₀ Br and gree their IUPAC names

H- SB 7613

M. Cleasify the following as alkyl, vingl, allyl or anyl helides



HALDALKAMES AND HALDARENES

6. Write IUPAC names of the following compounds

$$a=4.7H_{\star}^{-1}=0.7H_{\star}Br$$

D.S.B 2013

$$\mu_{i} = CH_{*,\alpha} C \pm CHCH_{*}C$$

$$v=2H_{\pi/2}\odot H_{1}\odot CH_{1}\odot H_{2}\odot H_{2}\odot H_{2}\odot H_{3}\odot H$$

OHr.S.R. 2014)

7. Write the IUPAC names of the following compounds

g) OH_CHCK(CH_AACCL_C_H_

Answers to Practice Problems

I₁ (p) CH_a—CH—CH_pI

2-Drumo-12-methy libutano

2-Bromabutane

8. (a vicinal b' gem d') vicanal.

5. (a) offyl (it vinyl (iii) vanyl chloride and allyl bromide

ar) olkyl (r) allyl (pt) aryl

6. 1/ 1-Bromo-1-chloro-1,2,2-triflacrosthans

(a) 4-Brimo-4-methylpant-2-eur

(iv) 1 Chluro-3-methythut-2-ane

.ti) 1 Bromo-4-chlorobut-2-yne

υ 4-1 Bromoethyl - chlore-2.2.7 trimethyloctane

v. 1 4-Enchloro-2-methylbenzene

b 1 Bromo-1-chloro-1,2,2-trufluoroethane

ett) 2-Chloro-6-methylpropaue

(a) 2-Bromo-8-chlorobutana

c I-Britan-4-chlorobat-3-yae

2,2-bia 4-chiomphenyl+3-bromobutane

d) 9-Trielloromethyl i 1 i 2,3.3,3-heptachloropropane

A 14 hloro 4:4-rodopheny) +3.3-dunethylbut-1-ene

2,6,6-Truinomheptana.

METHODS OF PREPARATION OF HALOALKANES OR ALKYL HALIDES

Haloalkanes are generally prepared in the inforatory by the following methods

1 From Alcohols

This is the most widely used method for the preparation of balcalkanes in the laboratory. The hydridity group OH of an alcohol is repisced by the halogen atom (X by reaction with concentrated halogen soids, phosphorus to idea or through ditionale. This can be done by the following methods

(a. By the action of halogen acids. Arcohols can be converted into halosikanes by treatmen, with halogen acids (HX. Hawever the rate of the reaction depends on both the hadare of alcohol and the halogen acid.

For example,

. Primary and secondary alcohols form unitoroalkanes when by drock and said gas is passed through alcohol in the presence of anhydrous zinc chloride. This is known as Groove's process

The purpose of anhydrous ZnCl is to beep in the cleavage of the $^{\infty}$ O bond. ZnCl is a Lewis and and therefore, it readily coordinates with the axygen from if the a robins. As a result, the C— $^{\circ}$ bond weakens and finally breaks to form corbocation. The carbocation, then reads $_{\circ}$ reacts with characterion to form characteristics.

Tertiary alcohols, are very renotive and therefore, they react readily simply by shaking with conc HJI even in the obsence of sinc chloride at room temperature.

Bromonikanes are obtained in a sine r manner by refluxing a smoothle a cohol with hydrotronic and 48% in the presence of a thic cone. H.St., which acts is a capityst

HBr being anatable can also be generated—v satu during the reaction by the action of conc. H $S \cup_{i}$ on KBr or NaBr

• Iodanikanes as a termed by senting alcohols with constant butting hydroiodic acid 57%. Like HBr HI can also be generated a same turing the reaction, by the action of 95% phosphoric acid in potassium ionabe.

HELP

Refluxing is a process of heating a liquid in a flask provided with a condenser. The vapours of the liquid which rise up get condensed back into the flask

-18/1E-

It may be noted that unlike alkyl habides, secondary and tertiary bromides and indides cannot be prepared from the respective alcohols. Thus is because secondary and tertiary accounts on heating with conc. H_sSO_s undergodehydration to form albeines.

Hydroger, fit on letta the least reactive of the hydrogen habites and the preparation of fittoria kases is not practical by this method.

The reaction is an example of nucleophilic substitution reaction in which nucleophile - e-hande ion) attacks the motion of a main with the expression of water is good leaving group.

Halida Protocoted

The order of reactivity of halogen acids with alsohols is

HI > HBe > HCl

Reactivity of alcohols is:

tertiary > secondary > primary

Thus is in accordance with the stability of carbocation formed in the granation state. The stability of carbocation decreases in the order $|3^\circ>2^\circ>1^\circ$ and hence the order of reactivity of alcoholisates decreases in the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases in the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases in the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases in the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates and decreases of the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases of the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases of the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases of the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases of the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreases of the same order $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreased order $|s|^2>2^\circ>1^\circ$ when $|s|^2>2^\circ>1^\circ$ whence the order of reactivity of alcoholisates decreased order $|s|^2>2^\circ>1^\circ$ whence $|s|^2>2^\circ>1^\circ>1^\circ$

The mechanism of this reaction is discussed in next axit

N U Curious...



- C. Neopentyl chloride cannot be prepared by the action of HCl on neopentyl atcohol. It can be best prepared by photochemical chiormation of neopentane?
- Neopentyl chronide cannot be prepared by the arthon of H." on neopentyl alcohol. This is because the reaction occurs through the formation of carbonation. The propentyl carbonation. 1° formed rearranges to 3° carbonation and the product formed is 2-chloro-2-methylbutane.

However, free radicals normally do not undergo rearrangement.

Therefore, neapenty, chi ande can be prepared by photochemics, free radical chiorination of neopentains

- (b) By the action of phosphorus buildes. Halosikanes can be prepared by the action of phosphorus halides on the accords.
- Chloroalkanes can be prepared by the action of phosphorus pentachloride PCI, or phosphorus trichloride (PCI,) on alcohols.

Bromoalkanes and **iodoalkanes** are prepared by the acts of R ephorus arctroande PBr_0 and phosphorus tradide PI_0 respectively on alcohols. Since PBr_0 and PI_0 are not very state—compounds, these are generally prepared m sum by the action of red phosphorus on Br_0 or I_0 as

(c) By the action of through chloride. Thioroxidance can be prepared from alcohols by refluxing alcohols with thioryl chronice in the presence of an organic state, ϵ_{ab} as pyrithme $\kappa^2_{ab}H_aN_b$.

This method is preferred than other methods because both the products of the reaction SO_n and HCT are gases and can easily swape travely both no pair waky that is T wreform the amore non-pounds can be pair free easily.

2. From Hydrocarbons

The muon kanes ran w prepared from alkanes, alkenes and alkynes by the replacement of hydrogen atom by halogen atom.

A. From alltudes

a Halogens of and Br.,) react with alkanes in the presence of altraviolet light to form haloalkanes. This reaction is free radical substitution reaction in gives a maxture of none, door populations, he was taken which are difficult to separate into pure components. Marsover the yield of any one compound is low because of the formation of other compounds. For example, in case of propage, a must are of two isomeric products are formed even when mono substitution is carried out.

The relative amounts of these momeric haloalkanes depend upon the nature of the hangen (Cl₂ or Br₂, and the number and type of hydrogen (1° 2° or 3°) being substituted. In general, the case of substitution of various hydrogens follows the sequence $9^{\circ} \rightarrow 2^{\circ} \rightarrow 1^{\circ}$

However, their relative rates vary with the nature of halogen. For example, with CL, the relative rates of substitution of 3° 2° and 1° tydrogens at 298K is 5 -8.8 -1 whereas with Br, at 450 K, these are 1600 - 62 -1. In addition, to above monochioro compounds, isometric dichard and tricks to compounds are also possible.

Therefore, halogenation of a hones is not a statutus method for abordious preparation of naturality as This is minuly because a mixture of different isomers are formed which are difficult to separate. However, free radical substitution is still useful in certain cases as discussed below.

When the mixture of products can be easily separated by some suitable method. For example, chlorination of methane gives different products which have suitable differences in the boung points. Therefore, these can be separated by fractional distillation.

when the sameture of a hance is such that the formation of isomers, product is not possible. For example, neopents he gives only one product because all the hydrogen atoms are an availant.

• • When there is a large difference in the reactivity of indrogens attached to different types of carbon atoms only me product is formed under statable conditions. For examine, the reactivity of different types of hydrogens in halo compounds are

Benzylie - allyhe > a.kyl > vinyhe - arylie

This is opposite to the homolytic bond dissociation equations. The vinylic and argue hydrogens are so unreactive that they do not porticipate in free radical halogeration reactions. Thus, allylic and benzylic hardes can be easily prepared. For example,

The high reactivity if a lylic conditionable hydrogen atoms can also be explained in terms of stabilization by resonance of the adjust and beingy in five radical intermediates during the reaction.

HELP

The 'half beaded' curved arrows 🖰 represent movement of a single electron

When pure products are not reprinted especially when hypothenes are used as solvents. The mixture of somers is just suitable as a pure compound and is much chesper. If needed, the product mixture can be separated into useful fractions by fractional distriction. By adjusting the proportion of the reactions, one of the products can be made to predominate which can be separated in good yield and purity. For example, methyl chloride can be obtained as a major product by taking large excess of methane. The unreacted methane can be separated and reused. The chloro and bromo derivatives of methane are prepared industrially by this method.

OF

5 The fluorination of alkanes with fluorine is highly exothermic and violent. This leads to propared and results into cleavage of carbon-carbon bonds. Alternatively, alkyl fluorides are more conveniently prepared indirectly by halogen exchange method as discussed later.

c locanotion is reversible but it may be carried out in the presence of an oxidising agent such as $H_{reg}(HN)$, etc. The exidising agent westroys the HI formed and thus drives the reaction towards the forward carection.

lodination stops at monorodo stage

B. From alkenes

47 Addition of hydrogen halides or halogen acids. Haloa,kones canne prepared by the electron and addition of halogen acids (HBr, HCl or HI) to alkenes.

It may be noted that in case of addition to symmetrical alkeries HC = CH be curben atoms joined by the non-law equivalent and, therefore, only one addition when it is formed. For example,

During the addition of hatogen and is to unsymmetrical alkenes, Markovnikov rule is followed. According to this rule

during the addition across unsymmetrical double bond, the negative part of the attaching reagent attaches itself to the earbon atom carrying lesser number of hydrogen atoms while the positive part goes to the earbon atom with more number of hydrogen atoms.

For example, in the case of propene 2-bromopropane is the major product.

However it has been abserved the when HBr is added to an ansymmetrical double roud in the presence of **organic peroxides** such as $bene on peroxide \stackrel{\sim}{\to}_0 H_{b} \stackrel{\sim}{\to} \stackrel{\leftarrow}{\to} - C \cup C_0 H_{b} \stackrel{\sim}{\to}$ the reaction takes place contrary to the Markovnikov's rule. This is known as an t-Markovnikov's rule or peroxide effect. It is also called **Manusch** effect. According to anti-Markovnikov's rule

in the case of addition of HBr to unsymmetrical alkene, the negative part of the attacking reagent Br) will join to the carbon atom carrying more hydrogen atoms while H-atom will go to the other carbon atom containing lesser number of hydrogen atoms.

For example
$$CH_8$$
 $CAI = CP_{a_2} + HBr$ $\xrightarrow{Parisido} CH_3CH_4CH_2Br$ $\xrightarrow{Parisido} Propene$ $\xrightarrow{Parisido} CH_3CH_4CH_2Br$ $\xrightarrow{Parisido} CH_4CH_4Br$ $\xrightarrow{Parisido} CH_4Br$ $\xrightarrow{Parisido} CH_4Br$

Thus different calon keyes are obtained from unsymmetrical a kenes as



HELP

It may be noted that the aut. Markown has rare or percende effect applies to the odd t on of HBr on γ and not to the addition of HI or HCI

Markovnikov rule and Anti-Markovnikov Rule

Mechanism of Markovnikov rule

The addition of HX to an albens occurs by the following steps:

Step 1. The alkane dangles a pair of electrons to the proton of the hydrogen habde and forms a carbonation

Step 2 The corbrection reacts with boude ion forming alkyl bolide

Theoretical Explanation of Markovníkov Rule

It, case of mayometrical alkanes, and, as propere. The step 1 would less to two different carbocations as

The replacement has as formed with a large property——leveled in the laste of the relative stability. Now we know that 2° carbocation is more stable with a fact carbocation, wherefore, the attack of H* ion on propene results to the formation of more stable carbocation. It is no fact or reacts with Br. to form the addition product.

This product is a accombance with Mark volkov rule. This, Markovinkov rule army also be stated in the alternative form as

The electrophilic addition to an unsymmetrical alliene always occurs through the formation of a more stable carbocation intermediate.

Theoretical Explanation of Anti-Markovnikov Rule or Peroxide Effect

The addition of HBr to a kenes of the presence of peroxides or are by **free radical mechanism**. In this mechanism, the first two steps result into the generation of free radical Br. Then, it adds to double bond in such a way to give more stripp free radica. The times free radical a extracts to H* free radical from HBr to complete the same on. The various steps of the mechanism are

The step ... gives two different free radicals. Since the 2° free radical is more stable than 1° free radical, it will be preferably formed giving the main product.

Exceptional behaviour of HBr. It is interesting to note that periodde effect is applicable only to HBr and not to HF. H. Tor HI. This can be understood in the passes of energy changes in the propagation step using different biologen atoms.

Step
$$H$$
: $X + CH_a$ $CH = CH_b$ \rightarrow CH_a CH CH_a X $X = F$ $\Delta H = 200$ kJ/mol $X = CI$ $\Delta H = 101$ ka/mol $X = Rr$ $\Delta H = -42$ k-J/mol $X = I$ $\Delta H = +12$ kJ/mol $X = I$ $\Delta H = +12$ kJ/mol $X = I$ $\Delta H = +27$ kJ/mol $X = I$ $\Delta H = +27$ kJ/mol $X = I$ $\Delta H = +27$ kJ/mol $X = I$ $\Delta H = -100$ kJ/mol $X = I$ $\Delta H = -100$ kJ/mol

From the above data at a clear that only with HBr both the steps are exothermic and hence free radical mechanism is possible. With HF or HCl, the attack of these longs follow free on an inechanism because the second step involving the attack of carbon radical with HF or H 1 a endothermic and a not favourable. In other words homolysis of HF or HCl does not take place. In case of HI the sometives of HI is possible as evident from step to but the attack of I or property loss not take place. Step to endot termine. So the free radical I will contain with similar free radical to form an molecule. Thus, peroxide effect is observed only in case of HHr.

(if Addition of balogens. When Br_n or Ct_n is added to alkenes, the addition occurs at the double bond forming conscitations.

$$\frac{H}{H} C = C \left(\frac{H}{H} + X^{\dagger} \right) \xrightarrow{CC} \frac{A}{H} \times KCH^{3}CH^{3}X$$

For example, when brumine in CCl₃ is added to eithere, the reddish brown colour of bromine gets discharged due to the formation of our-dibromide, which is relatives. This is an important test for the detection of double bond.

Allylic substitution

When alkenes are heated with fir or in, at a high temperature of about 775 K, the hydrogen atom of anylor carbon is substituted with halogen atom forming ally, habites.

Such reactions in which halogenation occurs at the active position of an arkene are called allylic halogenation reactions.

R U Curieus...



- Hologens (Cl₂ or Br₂, do not odd to the double bond at high temperature but bring about substitution at adylic position.
- At high comperature one addition reaction of halogens to alkenes is reversible so that the addition product formed during
 the reaction undergoes dehalogenations. HX more repidly than it is formed. However, at high comperature, the substitution
 reaction is arreversible and dence access to produce allylic substitution, product by a free radical mechanism.

Allylic bromination may also be carried out by freating alkene with N-bromo succurrence. NBS: When propers is treated with NBS in the presence of agent and peroxide as invastor, brominst on occurs at the metayl group forming a good yield of 8-bromoprop-1-ens, allyl bromide.

Allylic chlorination can also be carried but by treating alkelic with subject 1 chloride SO_sCl_s at 475 K in the presence of light and traces of perconde such as benzoyl perconde.

REMEMBER

SOCI, as through chloride and SO, Ci., as sulphory ichloride

C. From alkynes

(7 Addition of hydrogen buildes or halogon acids. Lake alkenes, alkynes add halogen soids to give antonikenes and drhalog kanes

Is may be noted that the addition of hydrogen handes to masymmetrica, alkanes, like alkenes takes place according to **Markovnikov rule**. Similarly in the presence of peroxides such as benzoyl peroxide $C_0H \circ C_0 = C_0 \circ C$

(17) Addition of halogens. Halogens add a nikynes in two steps forming blandes and then tetranalides.

3. By Halogen Exchange

This result in is particularly useful for preparing *iodonibunes*. The iodonikanes are obtained by heating chloro or bromosikanes with a concentrated solution of sodium, odde in arctime.

Sodium chronide and sodium bromide being less soluble in acetone get precipalised from the solution and can be removed by filtration. This also prevents the backward reaction to occur according to the Chatcher's principle. The reaction gives the best results with primary balides.

This reaction is known as Finkelstein reoction.

Fluoro alkanes are difficult to prepare directly. These are prepared by treating alkyl chlorides or bromides with saits such as mercurous fluoride. Hg. F. silver fluoride. AgF), cobalt fluoride. CoF_g) or antimony trilluoride (SbF_s). This reaction is known as Swarts reaction.

When the organic balides contain two or three halogen atoms on the same carbon atom. SbF_q or CoF_g are used. For example.

4. Preparation from Silver Salts of Acids.

The eilver saits of the carboxylic acids dissolved in \mathcal{M}_{i_1} are decomposed by bromine to form bromosilkanes. This reaction is called **Borodine Hunsdis** ik. reaction or simply **Hunsdiscker reaction**. The reaction is believed to occur by free radical mechanism.

The yield of balide is ρ : mary > secondary > tertiary and bromine is generally used.

Chloronkones can too be hanned by this method by using Ch, instead if Br., but the yield if ch prosikanes is very poor Iodonkanes cannot be obtained by this reaction because esters can be formed instead of iodonkanes.

$$2\mathrm{CH_{0}COOAg} \ + \ \ \mathrm{I_{2}} \qquad \xrightarrow{\mathrm{CCI_{4}}} \quad \mathrm{CH_{0}COOCH_{3}} \ + \ \mathrm{CO_{2}} \ + \ 2\,\mathrm{AgI}$$
 Methyl scetate

This is known as Burnbaum Simoning reaction.

SOLVED EXAMPLES

Example 6.

Write the structure of the major promier and ICPAC name in each of the following remains

$$(i) \cdot CH_{S}CH_{S}Cl + SbF_{S}$$

Heat

$$G = CH_{g^*}H_gCH_gCH + SOC$$

$$\tau = CH_aCH_aCH \Longrightarrow CH_a + HBr$$

Pornende.

$$\iota$$
 $CL_{2}CH_{2}C = CH_{2} + HBr^{-No permuter}$

$$\sim CH_{\gamma}CH_{\gamma}CH_{\gamma}Br+Hg_{\beta}F_{\beta}$$

 CH_0

$$C_{20} CH_{s} \in H_{s} C \cong CH + H_{s} = 1 \text{ equal}$$

Solution

This reaction is called Finketstein reaction.

Phiomethene

i-Bromonutane

to 2CH_CH_CH_Br + Hg_F

9-Bromo-9-methylbutane

I-F Interoprop

$$CH^2(H^2) + col^2$$

C.

3-Съогоргор-и-еве

Example 7...

Draw the structures of unifor monoholo products in each of the following reactions

 $\alpha = CH_aCH = CH_a \rightarrow$

e)
$$OH_{\parallel}OH$$
 + HCI head + (d) CH_{\parallel} + HI

NCERT

Chlorocyalobeaune

HELP

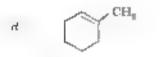
Since benzyur radionis are more stable, therefore enzywell is abstracted

CH,OF H.N

Cyclobetannil

4 → Bromoethy unitrobenzene

HELP Only alcoholic but not phenoas CH group is replaced by Clon beeting



ereleberane.

HELP

with HCL

I as a stronger nucleophic and hence displaces Br 1cn.

nithe presence or light

adylic bromination

occurs to form 8-Bromo-

ovelober-1-ene

hop

 \mathbf{Br}_{0}

3-Bromo-cyclobex-1-eea

br. + HBe

Example 8.

Draw and name is monochlost products you would expect to obtain from free rad is, information of 2 methyl pentana. NCERT

Solution Monochloro products from 2-methyl pentane OH, CH CH, CH, CH,

CH,

ĊL

C. CH. MCH.CH.CH.

ĊH₄.

1 Choro -- methytpentane

CH₃CH (Ato, PH₂CH₃

CH₂ ct.

8-Chairo-2-merbylpeurene

a CHACH PLOTHICS

ĆĦ,

1-Chioro-4-methylpentane

(II) CCHy CHyCTy

CH.

:-Cheoro-2-methylpentane

CH, CH CH, CHCH,

CH₂

2-Churo-4-methylpeutane

R U Curious.



- D Why canno. We get СИ СИСИДСИДСИ аlso?
 - CH CI
 - Пия за ватре на снасиси,силен. CH,CI

Chloro Grand gripenbase

Example 0.

Write the products of the following reactions

 $CH_u CH_u - CH = CH_v + HCI$

 Me_oCHCH_oOH

(iz)

80CI

(A.1 S.B. 2018) W.C K.R.T.

Solution

$$CH_{3}-CH_{2}-CH=CH_{1}+HCI \rightarrow CH_{2}CH_{2}, CH-CH_{3}$$

$$CH_{3}-CH_{2}-CH=CH_{3}OH \xrightarrow{S(0)} \rightarrow Me_{3}CHCH_{3}CI$$

$$H + HBr \rightarrow H \xrightarrow{H} H$$

$$Me_{2}C=CMe_{3} \xrightarrow{Br_{3}} Me_{3}C-CMe_{3}$$

$$Br = Br$$

$$CH_{2}-CH=CH_{2}$$

$$HBr \xrightarrow{CH_{2}-CH_{2}-CH_{2}-CH_{2}}$$

-Practice Droblems

8. How will you prepare the following from an alcohol?

.a) rec-Batyl bromide

(b) tert-Butyl chloride "

.c) 2-Bromopropane

(d) 1-Bromopropana

(e) Ethyl iodide

(/) Fluoroethene

 Identify at the possible monochloro structural comers expected to be formed on free radical monochromation of CH₂P₂CHCH₂CH₃.

Ans. There are four different types of 1 varaged atoms. Replacement of these bydrogen acoms will give the following isomers.

CH, ...CHCH_CH..C)

-Chloro-3-methylbutana

CII. 2CCII,CII.

CI
2-Chioro-2-methylbutane

© CICH, CHCH, CH,

| CH,
1-Chlonest-methylburine

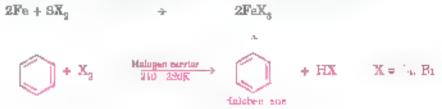
METHODS OF PREPARATION OF HALOARENES OR ARYL HAI IDES

The common methods of preparation of haloarenes are given below

Direct halogenation of a smallering or electrophilie substitution of arenes.

to Nuclear integernation. It considers any chlorides) and brompareness any brounder can be easily prepared by direct chlorination or brompation of benzene or other aromatic hydrocarbons. These reactions are carried out in dark at ordinary temperatures $31 + 32 \epsilon$ K in the presence of Lewis and catalyst such as anhydrous ferms or shimmoun handes. Feeligible FeBr₃, A. A_{ab} . These reactions are called **electrophilic substitution of orenes**.

The Lewis and acts as a natalyst and its function is to carry the halogen to the aromatic hydrocarbon and is also called **halogen carrier**. In actual practice, from filings in the presence of chiorine or bromine are commonly used. The halogens react with from names to form corresponding Lewis for is



Functions of the Hawgen Carrier and Mechanism of the Reaction

Halogenmons of precises as an electrophilic substitution reaction. The function of the tomogen carmer is to generate electrophilic which ettacks the beazens ring to form the product. For example, the chlorimation of beazens occurs as

Step 1. Generation of electrophile : The electrophile is generated as

Chioroganam son Electrophile)

Step it. Formation of carbocation (o-complex) intermediate. The electrophic dien attacks the senzene ring in form a carbocation aremum on or 6-complex which gete recommon stabilised. This is a slow and rate determining step.

"bluronce or ion Resonance stablesed carbonation

Step 8. Loss of proton from the enriodation intermediate. The resonance stabilized carbonation issue a proton (H* to FeCl₂) to give characterise. This is a fast step and therefore, does not affect the rate of reaction.

This step is fast and hence does not affect the rate of the reaction.

If excess of balogen is used, the second balogen also gets introduced in the ring mainly at o and p-positions with respect to the first his ogen because biologens are o, p- directing groups.

.p-Dichlorobenzana

Chlorination of toluene gives a mixture of or and p-chlorotoluene because. TH₃ group in training or the and para-directing.

(p-Chamotoluene)

The orthogod para-isomers can be easily separated due to large difference in their melting points **Bromo compounds** can be prepared in a n rular way by reacting with Br, in the presence of $FeBr_p$.



The reaction with **Buorine** is amount and summed be controlled. Therefore, finorearene cannot be prepared by direct fluorinesion of aromatic hydrocarbon

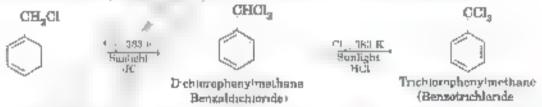
lodoarenes are slee difficult to prepare and these cannot be prepared by direct iodination because the reaction is reversible and HI produced is a strong reducing genu to reduce iodopenzene back of menzene.

Therefore, the reaction is carried out in the presence of an and sing agent like todic and or neither and or mercuric conde, etc which condises Hi formed in the reaction to rodine. This enables the reaction to proceed in the forward direction.

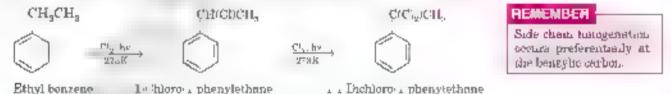
(b) Side chain halogenation - Preparation of aralkyls.

Side chain substituted anyl halides or arealty halides are prepared by direct halogenation of a suitable hydrocarboi. For example, when obloring gas is passed through tolliene in the presence of suitaght substitution takes place in the side chain.

If Cl, is passed in excess, the other two hydrogen at major side chain also get substituted by halogen atoms.



When the side chain is larger that a methyl group, the side chain halogenation occurs preferentially at the benzy be carbon atom next to the senzene ring. Therefore, it is also called **benzylic halogenation**.



Instead of Cl_n symple ryle bounder SO_nCl_n at 475K in the presence of light and traces of peroxide may also be used for side chain halogenation of arenes.

REMEMBER

The side chain halogenation like halogenation of alkanes is a free radical substitution reaction. This is unlike nuclear halogenation which occurs through the intermediate formation of carbocations.

From diazonium salts

(r) By Sandmeyer reaction.

Chloro and bromoarenes are prepared by treating a freshly prepared diszonium sait solution with cuprous chion is or cuprous bromide dissolved in corresponding adogen ands. This reaction is called Sanding very require pr

The benzene diagonal in salts required for this purpose are prepared by treating research southon of anime in excess of diute HCl with an agreeous solution of sodium natrite at low temperature, 173-278 K 0.5°°. The reaction is known as diagonisation reaction.

The reazene diazon: in: oak is used for preparing anyl habdes as

However for preparing iodoarenes, replacement of the diszonium group by todine does not require the presence of express halides and is done supply by shaking the diszonium salt at most with aqueous KI solution

This is usually the best method for introducing iodine into benzene ring

Fluoroarenes are prepared by area in gluenzene diazonium chioride with fluoroboric and. This reaction produces diazonium fluoroborate which on heating produces fluorobenzene

The reaction is called Bulz-Schiemann reaction.

th By Gattermann reaction. Hatourenes, particularly chiorogreues and bromogrenes are prepared by Gattermann reaction, which is a modification of Bandmeyer reaction. The Bandmeyer reaction that been modified by using copper powder in the presence of corresponding hatogen acts. HJ or HBr) in place of coprous hande this civil a corresponding hatogen acid. CuCl/HT or ChBr/HBr.

$$N_2^+$$
 CF CI N_2^+ CF Br $Cu, TiBr$, $Cu, TiBr$, $Chiarebansana$ $Bromobensone$

3. From silver salt of aromatic acids † Hunsdiecker reaction

Like alkyl broundes, and promites can also be prepared by refluxing the silver sait of aromatic acids with browne in carbon tetrachloride.

Silver benauate

Brownbeasene

4. Commercial preparation of chlorobenzene. Raschig process

Chioroneuzene is prepared commercially by passing a maxture of senzene vopours, or and hydrogen olderide over heated rupric chiomde

$$2C_6H_6 + 2HCl + O_6 \xrightarrow{\text{Outly, A}} 2C_6H_5Cl + 2H_6O$$

This is Reschig process.

R U Curious...



- Halonikanes can be easily prepared from alcohols by replacement of the OH group by the halogen atom. Why cannot we prepare haloarenes from phenol?
- Haloarenes cannot be prepared from phenor as alkylorades from alcohors secause the different to repeate the different phenor that different to repeate the different phenor that carbon-dayen bond in phenols has partial double bond character and is therefore, stronger than carbon-dayen single bond in alcohors. As a result, the cleavage of carbon-dayen, bond in phenols is a difficult under ordinary conditions.

SOLVED EXAMPLES

Example 10...

Draw she structures of the major monthsuo product in each of the following

de faither

PHYSICAL PROPERTIES OF HALOALKANES

The important physical properties of halosikanes are

- I Physical state and smell. Haloa,kanes in general are color riess (when pure), sweet-smelling liquids. Brounder and particularly took less develop of four when exposed in the However, the lower members like methyl climate, methyl brounde and ethyl chioride and some chiori fluoride techanes are colourless gases at room temperature. Higher members are liquids or solids.
- 2. Solubility. Although in mikanes are pour a new required to recrome the attractions between the babalkane in order for a natonika is to besolve it water energy is required to recrome the attractions between the babalkane in declars and break the hydrogen longs between water molecules. However, however, however not able to form hydrogen bonds with water and therefore, less energy is released when new attractions are set at between the handalkane and the water in decides because these are not as strong as the original involved monds in water molecules. As a result, solubility of handalkanes in water is low. However, the information forces between handalkanes and solvent molecules have much the same strength as the ones here, broken in the separate handalkane and solvent molecules.
- 8. Density Simple fluoro and choros kenes are lighter than water while bronnings and polychloro derivatives are heavier than water. The densities increase in the order

	fluoride & chier	ride « chioride « bromide « todide.		
	$a \in_{\mathcal{A}} H_T \cap$	$n \sim _{\mathbf{a}} H_{\mathbf{y}} \mathbf{B} \mathbf{r}$	$a_{\tau}C_{a}H_{\tau}J$	
Density (g mL 1)	0.890	1.886	1 747	
With increasing size of the alky	I group, the density	es of the ackyl balo	des go on decreasu	பூ
	CH ₂ I	CH_CH_I	$a \cdot C_3H_7I$	$\kappa_{\rm e} C_{\rm a} H_{\rm p} I$
Density g mL	2.279	1 993	1 747	1 017
The density size increases with	uncreasing number	and atomic mass o	f the halogen	
	OH_2Ol_2	CHCl ₈	CCi ₄	
Density (g mL-1)	1 336	1.489	1,595	

4. Melting and Boiling points. Milecules of organic haloges, impounds are generally point. Due to the polarity as well as higher moseouser mass as compared to the parent hydromrhom, the intermolecular forces of attraction dipole-dipole and can les Waals) between the milecules are stronger in halogen derivatives of alkanes. As a result making and binding points of chiandes, broundes and od des are considerably higher than those of the parent hydrocarbon of comparable molecular mass.

Amongst themselves, the following trends are observed

For the same alkyl group the boung points of alkyl chlorides, bromides and todides to low the order $RI > RF > R \setminus I > RF$ where R is an alkyl group. This is because with the increase in the size of the hangen, he magnitude of van are Woals forces, accesses and consequence, the boiling points increase as shown below.

Haloalkane	CH ₃ F	CH2C1	CH _a Br	CH ^o I	CH,
bp K	104.0	248 8	279.0	3,5,4	1

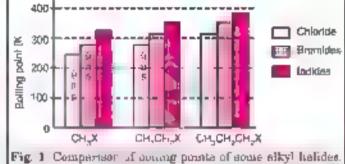
In general, the boding points of chlore, brome and lode compounds increase with increase in the number of halogen atoms.

Haloalkane CH₂Cl CH₂Cl₂ CHCl₃ CCl, b.p. (**K**) 249 313 394 360

(in). For the same honogen atom, the boung points of anioalkanes increase with increase in the size of alkyl groups

Haloaikane ("H₂C) CH₃C CH

To For isomeric sikyl halides, the boiling points decrease with branching. This is because branching of the chain inables the materials more compact and itterefore decreases.



he withing arm. Due to decrease a carfare area, he magnitude of can, we what a forces of attract in necreases and consequently, he boding points of the branched chain compound is less, but, but of the straight chara compounds.

For example.

				CH ₁
Huloaikane	$CH_{q^{\prime}}H_{q}CH_{q}CH_{p}Br$	CH5-CHCH2Br	CH'C) FCHCH	CH ₂ $\leftarrow \Delta h_0$
b.p. (K)	n Butyl bromide 875	CH ₃ Isobutyl oromade 864	Sec-Butyl brounde 264	Br cert-Bucyl promide 946
Haloalkane	$\mathrm{CH_3CH_4CH_4^*H_4CI}$	сен _{ас} ен зи _с ог	CH3CH4CH CUCH3	C.H ^{5 a} t. rt.
b.p. (K)	a Butyl chlomde 351 5	anhrity) chiomite 343	ser-Butyt chiomde 841	tert Butyl ch omde 334

The pettern of variation of boiling points of different askyl halides is shown in Fig. 1

6. Inflammable nature. Halogen compounds are less inflammable than hydrocarbons. The inflammability decreases with increasing halogen content. Interestingly curbon tetrachloride is used as a fire extinguisher under the name pyrens.

Since organic to oger compounds are good solvents for one and fars and size do not catch fire read v. For example, po vehicro compounds such as n = n! distribute have are which used as solvents for try cleaning. Tarbon tetrachionide is used as a fire extinguisher under the name pyrene.

6. Polarity and Dipole moment. The exchanging gen bond in indealenes is pour because of electronegativity difference between carbon and the mount. As we have from F to I, the electronegativity of the halogen decreases

F Cl / Br I Electronegativity 4,0 8.0 2.8 2.5

Therefore, the potenty of the carbon-halogen $C\!-\!X$ bond and hence the dipole moment of the hazalkane should also decrease accurately. However, the dipole moment decreases from GI to Br to I, but dipole moment of ${}^{2}H_{3}F$ is slightly lower than that of ${}^{2}H_{3}CI$



The lower dipole moment of CH_sF than CH_sCI is due to the small size of fluorine. Although the magnitude of the charge on F sum is much larger than that on the C' stom out due to small size of F alom as compared to CI atom, the CHF bond distance is so small that the product of charge and distance is dipole moment of CH_sF comes out to be slightly lower than that of CH_sCI .

C-F C-CI C-Br C-I Bond length 180 pm 178 pm 198 pm 214 pm

PHYSICAL PROPERTIES OF HALOARENES

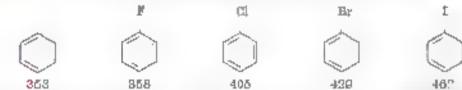
The important physical properties of baloarenes or aryl balides are

- These are generally colourless aquids or crystaline solids.
- 2 The ary landes are heavier than water. These are insoluble in uniter but soluble, in organic soluents.

- 10/32 -

b.p. (K)

- 3. These are beavier than water
- 4 The me tang and wall g points of arvinances are nearly the same as those of alkylitariles containing the same number of carbon stoms. The booking points of monohalogen derivatives of benzene are in the order todo > bronto > chloro > fluoro



This trend is same as for alkyl halides.

For the same halogen atom, the melting and boiling points, occase as the size of the aryl group increases. The boiling points of isometic disal occase are nearly the same but their melting boil a are quite different as shown below.

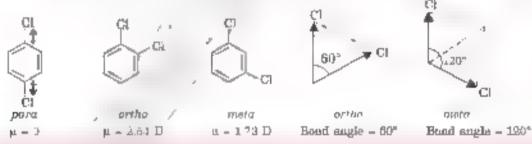
Generally the melting point of para isomer a finite ligher than that of orthe or meta asomers. This is due to the fact that synchrotren sometime and therefore its man as not carry pack courses in the create lattice. As a result as meltine and at higher temperature, on one stronger on the meltine energy is required to break as totice and it melts at higher temperature.

Fluorobenzene of forobenzene and bromober zene fit we lower dipote moments than the corresponding methylan idea.

C₆H₆F C₆H₅Cl C₆H₄Br C₆H₄I 1.60 D 1.69 D 1.70 D 1.70 D

The lowest dipole moment of flaprobenzens is probably due to small size of F stom.

Amongst isomeric dichiorobenzenes, the presoner was zero dipole moment because it is symmetrical and two equal and opposite Impoles cancer each other. The dipole in meet of orderly robenzene is more than no dichiorobenzene.



The dipole moment of the ϕ - and a-recover decreases as the bond angle between the two halogen a one increases in accordance which are law of parallelogram of forces. According to the law of parallelogram of forces, the resultant dipole moment is given as

$$\mu = \left(\sqrt{\mu_x^{-2} + \mu_y^{-2} + 2\mu_1\mu_2}\cos\theta\right)$$

where μ_1 and μ_2 are the dipole moments of C_1 X bonds and $\mu_2 = \mu_2$ and $\cos 60^\circ = 0.5$, $\cos 120^\circ = -0.5$

$$\mu$$
 (ortho) = $\sqrt{\mu_1^2 + \mu_2^2 + 2} = 0.5\mu_1\mu_2$ and μ (meta = $\sqrt{\mu_1^2 + \mu_2^2 + 2 \times 0.5\mu_1\mu_2}$

Thus, the a-isomer with a loud angle of 60 between the two Cl atoms and higher dipote moment while masomer with loud angle of 120° between the two Cl atoms with save lower up to moment

NATURE OF C-X BOND

The carbon-balogen bond in alky-halides results from the overlap of a carbon sp^0 hybrid orbits, with an orbital of to tigen atom. Therefore, a kyl trades take tetra tedral geometry with $H_{-}P_{-}X_{-}$ would angles nearly 1.00° . As the size of the halogen atom increases no gaing lower the group, the conditional mathematical accordance accordingly and the bond inspondent enthances of C—X ionic decrease. To be 2. As we know halogens are more electronegously.



then earbon. Therefore, C. X bond is point with the carbon having slight positive charge δ^* and halogen atom bearing a slight negative charge δ . As a result, the δ -X bond is polar

The polarity of the ΣX bond decreases with decrease in electronegativity of halogen atom. As a result, dipole moment decreases as given in Table 2.

Table 2. Comparison of bond length, bond energy and dipole moment of bolomethones.

Halomethane	Bond length tpm/	Bond entholpy kJ mol*)	Pipole moment (D
CH ₂ F	199	452	1 947
OH _a OI	178	961	/ 4 1.860
CH ₂ Br	193	298	1,880
CHT	714	254	1 636

CHEMICAL PROPERTIES OF HALOALKANES

Heloalkanes are one of the most reactive masses of organic compounds. These can be used for the preparation of a large variety of useful organic compounds. Therefore askvi haudes are regarded as synthetic tools in the hands of a chemist. Some of the reactions of askyl haudes are given below

A. Nucleophilic substitution reactions B Elimination reactions

C. Reactions with metats

D. Reduction

A. Nucleophike Substitution Reactions

In halosalkanes, the carbon, abonded to a halogen atom, X = F - T. By I, which is more electronegative than carbon. Consequently, the C - X bond is polar in nature. As a result, was in gets partial positive charge δ^* on the inlogentation gets partial negative charge δ^* . The polar nature of $- K V^{\dagger}$ handes makes them, lightly reactive in decides.

The presence of partial positive charge on the carbon alom makes it susceptible to attack by electron rich groups called nucleophilos. When a pisches into suranger that the is ide ion approaches the positively charged carbon atom of an alkyl habite the halogen as on along with its bonding electron pair gets displaced and a new bond with the carbon and the nucleophile is formed.

These reactions in which a stronger nucleophile displaces a weaker nucleophile are called nucleophilic substitution reactions.

There are two types of numerophiles which participate in substitution reactions of alkyl halides. These are an Negatively charged species

b, Neutral species with at least one lone pair

Therefore, nucleophilic substitution of a haloulkane is described by either of two general reactions. Negative nucleophile gives a neutral product.

Neutral nucleophile gives positively charged product as a salt).

In these reactions the atom or group of atoms which isses its bond to carbon and takes on an additional pair of electrons is called **leaving group**. Halido cons are good leaving groups. Better the teaving group, the faster is the nucleoph its substitution reaction. Among the arkyl halides, the teaving group ability increases along the series from fluoride to codide as

Leaving group ability $I^* > Br^* > Cl^* > F^*$ Best Poor

Thus, todade is the best leaving group and therefore, todoslkanes undergo nucleophilic substitution reactions at the fastest rate. In the other hand, fluoride ion is the poorest leaving group and therefore, fluorosikanes are least reactive.

Order of Reactivity of Haloalknnes

The reactively of an eachers is due to the polar nature of C-X bond. The polarity of the bond depends upon the electronegativety difference between the carbon and the halogen atom. The polarity of the X- bond in methyl haldes decreases in the order

$$CH_3$$
— CI > CH_3 — Br > / CH_3 — I
1 80 D 1.83 D 1 936 D

Therefore, the experted order of reactivity of haloalkane is

However, the actual order of reactivity of initialkanea is just the reverse

This order is that to the bond dissocration endulpy, in the energy count of to employ the $C \setminus X$ bond. Lesser the bond dissocration on energy more w is be the many styling that have $M_{C} = 0.1$ association energies of $C \setminus X$ on , are

Bond	C—C.	r.— Br	C1
Bond dissociation enthalpy kJ mol-1	820.4	284.5	213.4

Therefore, the ≥ 1 band can easily be cleaved while and $\geq C1$ band is cleaved with difficulty F'' and forms the strongest band w_i the carbon among w_i the hatogens and therefore is least reactive. In fact, the C+F band is so strong that organic fluorides do not undergo nucleophiae substitution reactions under ordinary conditions. This explains the order of reactivity of hatoalkanes.

Reactions of Haloalkanes

Some important nucleophilic substitution reactions of baseautiones with common nucleophiles are given in Table 9.

Table 8. Nucleophilic substitution reaction of alkyl haudes ,R—X Nu + R X → R—Nu + X

410 1 10 10 10 10						
Rengent		Nucreophile Nucl. 7	Substitution product R—Nu	Class of main product		
1 NaOH or K∪H or moust Ag ₀ ∩ H 2. H_O H_O 3. R'ONa OB'			ROH ROH BOB'	Alcohol Alcohol Ether		
4 NaI 5 NH ₃	1	r tNH,	R—I RNH _E	Alkyl rodide Primery amuse		
o, R'NH _E	,	R'N H _g	RNHR'	Sec. amme		
7 R'R'NH		/ RRNH	HNR'R"	Tert smune		
a. KCN	1	C=N:	RCN	Nitrile cyanide		
e Agen 10. Kno _s		Ag—C'V: O=N -O:	RNC R-O-N-O	Isomtole Isocyanide Alkyl natrite		
II AgNOg		O—VA	R—NO _g	Nitrordkame		
15. R'COOAg		R'COO	R'COOR	Ester		
13 NaHS		-SH	RSH	Theareshol		
14 R'SNa		SH'	R5R'	Throather		
15. NaNa		$\ddot{\mathbf{N}} = \ddot{\mathbf{N}} = \ddot{\mathbf{N}}$:	R N = N = N:	Axida		
16. LiAlH _e		H.	RH	Hydrocarbon		
.7 R' M*		R'-	RR'	Alkane		

These nucleophske substitution reactions of halosikanes are discussed below

1 Substitution by hydroxyl group formation of alcohole. Haioalkanes react with boiling aqueous alkali (KOH) or most silver oxide Ag₂O/H₂O to form alcohols.

Substitution by alkoxy group formation of ethers). Hanalkanes react with sociam or potassium alkoxides to form ethers or alkoxyalkanes.

This reaction is called **Williams in a synthesis** and is quite useful for preparing ethers. He calkanes can also be converted into ethers by heating with dry aliver builde.

$$2CH_3CH_2Br + Ag_2O \xrightarrow{Heat} CH_2CH_2CH_2CH_3 + 2AgBr$$
Ethoxyethane
Diethyl ether

3. Substitution by eyano group (formation of eyanides or nitriles). Halos kones react with a coho a solution of potassium cyanide. KAN to give alkane mariles or askyl cyanides as the major products along with a small amount of alkyl isocyanides.

Alkyl cyanides can further be converted into acid amides, carboxy-ic acids and primary amines under different conditions. Therefore, they are useful starting materials for these compounds.

Part as hydrotym as to row HCi or a matter hydrogen peroxide (H_nO_n) gives acid amides

$$C_2H_5C=N$$
 \Rightarrow H_2O $\xrightarrow{\text{conc. HCl.}}$ $C_2H_4CONH_*$
Ethy-cyanide $C_2H_4CONH_*$

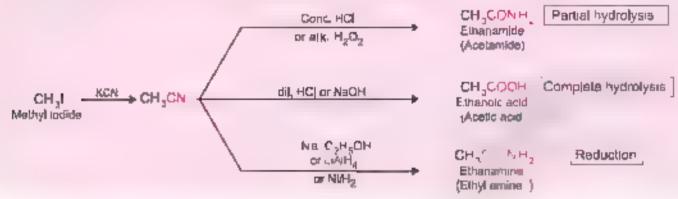
A Compute hydrogous with dilute in nero accorate caustic a kali gives earboxylic acid.

Reduction with sodium and alcohol Mendius reaction forms primary amine

$$C_2H_5C=N$$
 + 4H $\xrightarrow{Na/C_2H_2OH}$ $O_9H_2CH_2NH_9$
Sthy) cyanide $\xrightarrow{n \text{ Frapy}}$ amine

The reduction can also be carried out with H_s in the presence of N_t or Pt known as catalytic hydrogenation) or with lithium aluminum hydride (LiAl H_s).

It may be noted that the reaction of bakes kanes with a collabor KCN as very important because the product formed has one more carbon atom than the sixyl bailds. Therefore, the reaction is a good method for increasing the length of the carbon chain by one carbon atom c. for ascending the homologous series.



The formation of primary amines by reduction what neacent hydrogen, obtained by the action of sodiam on alcohol is called Menchus reaction.

 Substitution by isocyanude group (formation of isocyanudes). When halostkane is treated with alcoholic suver eyande. AgCN - sucyanties are obtained. These are also called orby names and have extremely impressant. amei)

Allryl recognition on reduction until audition or alanhol give accordary aminos

N U Curlous.



A currous question may come to our until as to why haloulkanes give symmes with KCN and isosymudes with AgCN as the product.

The symmet ion is a reconnice hybrid of the following structures

It is clear from the resonating structures that eyemide on can attack the nucleophilic are through C as well as through N. Such a microphile with his capitho of attacking brough more duan one atom faite is caused, ambident nucleophile. Thur, CN behaves as an ambident nucleophile.

KCN or NaCN is predominately tome and therefore both C and N atoms are free to denate electron pair Since "-" band is relatively stronger han " N bond tierefore, the aster's occurs mostly direigh the curbon atom of the eyemde group forming alkyl eyenticles as the major product

$$K = R + R - X$$
 $\rightarrow R - C = N + KX$

Alkyt cyanide

On the other hand Agri'N is predominently revalent Therefore in this case only Nintom is free to donate electron pair and the ettack mostly occurs through he Notom of the eyemde group forming alkyl isocyanides as the major product.

$$Ag \stackrel{\frown}{C} = N + R - X \longrightarrow R - N = C + AgX$$

$$A \text{ kyl paucyanada}$$

BON ROW musck seriors through " Thus. Alkyl cyanide AgCH R NC (attack occurs through N) Alkyl uocyanida

r,g.,

5. Substitution by amino group (formation of aminos). When halcalkane is beated with alcaholic ammonia solution in a sealed tune at 388 K, halogen is substituted by NH, group to form primary amine.

REMEMBER

In presence of suver salts, cyande accords accords to tropen and a strong twentimed in cyanida attacks hough carbon.

However, when halos kane is in excess, one or both the hydrogen atoms of the secund alkane, primary anome are replaced by alkyl groups and a mixture of primary secondary and terhary amines is formed.

Tertiary ammes so obtained can also combine with another alorecule of a kyl $n_0 + n_0$ form ounternary anunomous salt

$$CH_8CH_2Br + (CH_9CH_2)_8$$
 N \Rightarrow [$(CH_9CH_2 + N)^*Br$]

Tetraethyl anunomum browide

Quaternary solt

This reaction is called Hoffmann ammonolysis reaction.

6. Substitution by mitrite group (formation of mitrite). When a haloalkane is treated with sodium or potassium mitrite the halogen along gets substituted by " fr-te group →N=□ forming alkyl mitrites.

7. Substitution by nitro group (formation of nitro alkanes). When balon kane is treated with silver intrice AgNo.... the balogen atom is replaced by nitri group. No.. to give introduceness.

Nitrite ion: O N = O like evalude ion is an ambident nucleophile because it has two sites oxygen or introgen through which it can attack the asky hands Attack inough introgen gives ratio compounds and attack shrough anygen gives ratioles.

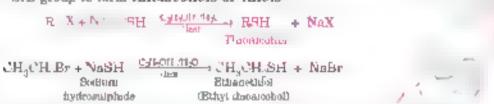
Alka a metal arters as \mathbf{N}^{C} , are into compounds and the bond between $\mathbf{K} = \mathbf{C}$ is the and therefore the agestive charge on anygen, as one attacking size. Hence, the actack of oxygen end on alkyl axiode forms alkyl nitrites $\mathbf{R} = \mathbf{O} - \mathbf{N} = \mathbf{O}$.

$$\mathbb{R}^+$$
 $O - \mathbb{N} = O + \mathbb{R}$ $X \longrightarrow \mathbb{R} - O - \mathbb{N} = O + \mathbb{K}^+ X$
Pulsanium nitrita

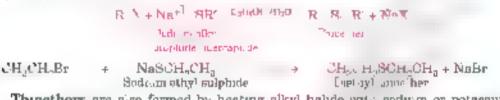
In the other hand, silver natrite AgN— is a covalent compound and the bond between Ag— I is covalent. Therefore, it loss not have a negative tharge on the oxygen atom. Hence, the interophilit actual return through the ione pair on nitrogen forming introdikanes (R—NO₂).

8. Substitution by corboxyl group formation of esters). Haloalkanes form esters when heated with an ethanolic salution of silver sult of a fasty and

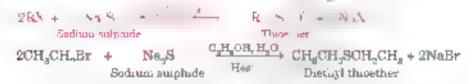
O. Substitution by hydrosulphide group (formation of thinalcohols). When halicalkane is treated with aqueous ethanous socition of sode on or potassium hydrogen suspicide the halogen at the gets reproved by hydrosulphide (—SH, group to form thicalcohols or thicks).



10. Substitution by alkyl sulphide group (formation of thioethers). By tenting a mixture of haloalkanes with aqueous alcoholic sodium or pot smilet o kyl sulphides, throethers are formed.



Throethers are also formed by heating alkyl halide with sodium or potassium sulphide



HELP

- The sulph ar analogues of alcohola, R. SH are called throas. The ending that is mided by alkane stem to give the name alkane three.
- The SH group is referred to as mercupia group
- The sulphur analogues of ethers are called throethers or sulphides as me asky ether noncondature as "H₂SCH₂CH₃ Ethymethy' throether or ethylmethyl surphide
- The RS group is named as alkylthro group and RS: group is named as alkyl (brotate of PH₂S Na Sod and methyl displace.

 Substitution by azide group formation of alkyl azides) When haloalkane is treated with sodium azide, they form alkyl azides or azidoalkanes.

Alkyl azides are resonance hybrid of the following two resonance structures

$$R \quad \stackrel{\downarrow}{N} \quad \stackrel{\downarrow}{N} \stackrel{\downarrow}{\longleftarrow} R \quad \stackrel{N}{N} = \stackrel{\downarrow}{N} = \stackrel{\downarrow}{N}$$

12. Substitution by alkynyl group dormation of higher alkynes: When we talk an est treated with sodium sait of a kynes sodium a syndes, the hangen atom is replaced by alkynyl group. C=C- to form ingher alkynes.

The sodium alkymdes needed for the above reaction are formed by the reaction of sodamide or sodium in inquid NH₂) with alkynes containing terminal triple bond.

$$H-C=C$$
 $H+NaNH_a$ $\xrightarrow{a_1Nib_2}$ $Na^*C=CH$ $+$ NH_a Sodum acceptate



Two types of Nucleophilic Substitution Reactions

The nucleophius substantion reactions of alkyl halides have been found to proceed in the following two types of mechanisms

- Substitution nucleophilic bimolecular, B_N2
- 2) Substitution nucleophilic unimolecular, 5,1

(1) Substitution nucleophilic bimolecular, S_N2 reactions.

The rescuon between methyl brounds CH₂Br and hydroxide on (CH²) to form methanol follows a second order kinetics is rate depends upon the concentrations of both reactions alkyl halide and hydroxide in:

The rate of the reaction may be expressed as

Rate = k|CH_oBr||OH⁻|

In fact, methyl or primary askyl habdes follow this type of mechanism and a may in general be written as $Rate = \$[RX] \text{ } [OH^{-1}]$

This reaction is also called nucleophilic substitution bunolecular because two molecules take part in determining the rate of the reaction. It is written as $S_{\rm k} \lambda$ short form for substitute a interrupt ar homogen or

This type of reaction occurs in single (concerted) step through the form. In of a transition state, I., this mechanism the nucleophile. If attacks the partially pushavely charged carbon atom of carbon balogen band from the direction 180° away from the telegraph atom is from the backside. This leads to a transition state with a partially formed C. OH band and a partially broken C. Br band. This process is said to be a one step reaction, in the transition state, the negative charge is shared by both the magning in eleophide as well as not going brounde. Hydrounde has diminished negative charge because a bas begun to above its electrons with carbon while brounde has developed partial negative charge because it has partly removed a pair of electrons from carbon. Therefore, both of have partial negative charge see it has partly removed a pair of electrons from carbon. Therefore, both of have partial negative charge see it has partly removed a pair of electrons from carbon. Therefore, both of have partial negative charge see it has partly removed a pair of electrons from carbon. Therefore, both of have partial negative charge see it has partly removed a pair of electrons from carbon. Therefore, both of have partial negative charge see it has partly removed a pair of electrons from carbon in the transition state adopt a planar arrangement. This arrangement may be described as the C—H bonus are arranged like the spokes of a wheel with C—OH and C—Br bonds lying along the axle.

The transition state is metable because tarbon atom is sum the constant condects five atoms and therefore, changes to products in which bromide ion leaves forming a 3—4 bond. This reaction is shown below

HEI P

in these reactions bond making occurs at no more time as and areaking. Here are the two events occur in concert, we call the reactions as concerted reactions.

As you have learnt in previous rises, solid wedges represent the bond coming out of the paper, dealed line represents the bond going learns the paper and straight lines represent bonds in the plane of the paper.

In terms of models, the reaction path may be diagrammatically represented as given in Fig. 2.

It is clear from the above one step mechanism, that the formation of remation state is rate determining step and therefore, the rate of the reaction depends upon the concentration of both alky, hande and ∂H . Hence it is a second order reaction or a bimolecular reaction.

It may be noted that as a general rule nucleophilic substitution occurs only when the group being displaced X is easily able to leave taking with it the electron pair of the X. X bond. The relative ease at which it can be displaced or its leaving group ability depends upon its capacity to accommodate the negative charge. For the halogens the leaving group ability increases along the series from fluorine to Jodine,

Thus, adde is regarded as a good leaving group while fluoride is regarded as a poor leaving group.

Reactivity of alkyl halides towards S_N2 reaction

The reactivity of a ky had hes towards See mechanism has been found to be in the following order

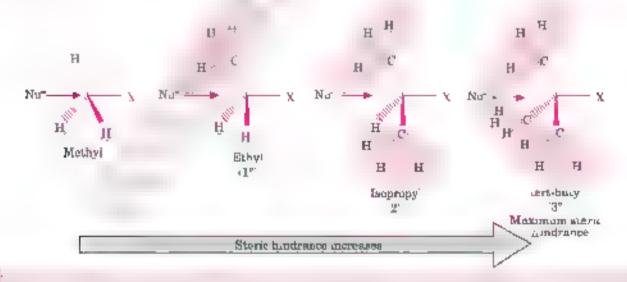
Methyl halide > Primary halide > Secondary halide > Tertiary halide

This can be easily explained on the basis of formation and stability of transition state in the reaction. Since the reaction requires the approach of the π -deophile to the carbon bearing the leave g group, the presence of taky substitutents on or near the carbon hinders the attack of nucleophiles and therefore slows the reaction. This interference of the m ky groups with a reaction as m editorial editorial hindrance. Therefore of the simple alkyl handes methy haldes react most rapidly in $S_{N}2$ reaction because there are only three small hydrogen atoms least steric hindrance. In the other word, tertuiry alkyl halides are least reactive occause of m presence of three only groups on carbon (maximum steric hindrance). Thus, the order of reactivity is

$$CH_{\bullet}X > 1^{\circ} > 2^{\circ} > 3^{\circ}$$
 slkyl halide

For example, the relative rate of alky handes towards $S_{\rm N}2$ maction has been found to be

The steric effects in $S_{n}2$ reaction are shown below



NOTE

man be auted that deopenty' chloride is primary attornde reacteabout 2500 times more slowly than isopropy) chloride is secondary thronds. This is due to an extremety bulky sent in tyl group or tached to the electrophilic raption. A single sent but yl group hinders the backerds approach of nucleophile even more than two methyl groups.

2. Subsettution nucleophilic unim decidor. Sc. reactions.

The reaction between tert-butyl bromide and hydroxide ion to form tert-butyl alcohol follows first order kinetics are the rate depends on the concentration of one reaction only. It has been observed that rate of reaction depends only on the concentration of alkyl halide

The rate of reaction may be expressed as

Rate = $k_0 \text{ CH}_{p/s} \text{CBr}$

or simply, Rate = k [RX]

This reaction is called substitution nucleophilic inconfecular been iseonly one molecular a avolved in determining the rate of the reaction and is written as S_{m} 1 reaction. Such type of reactions are generally carried at the polar protoc solventa auch as water, alcohol, acetic acid, etc.

The S_N1 mechanism occurs in two steps.

Step 1. Formation of carbocation. The polarised C —halogen band, C — Br. undergoes slow derivage to form a carbocatain and a hande ion.

Step 2. Nucleophilic attack on carbocotion. The carbocotion is very reactive species. Therefore it readily reacts with a nucleoptale, OH: to form the product.

tert-Butyl parbocation.

The first ster, is slow and reversible. It involves the decounge of C.—Br bond for which energy is obtained through solvation of brunide anade on with the proton of the proton of the solvent Since the solvest step is the rate determining step, the rate of reaction depends only on the concentration of tert-butyl bromids, alkyl halider. Hence, it is a **first** order or ummotecular reaction.

The S_n I mechanism is facilitated by no or profit solvents such as water, alreadof or aqueous organic solvents. These solvenes promote the ionisation step is submixing the ions by solvation.

Carboonton Rearrangements: A unique property

Carbocation Rearrangements

The S_{n} I reaction proceeds through the formation of a carbocation. The carbocations have the unique property of rearrangement. Corbocations rearrange of they become more attack as a result of rearrangement. Therefore, the products formed are different than expected products.

However, rearrangenies to x_1 over $r \in S_{\mathbb{N}^2}$ reaction where no carbocation is to formed and one step mechanism does not allow any rearry age neat. Therefore, if the emboration formed in an S, I reaction can rearrange, then $S_{\rm n}1$ and $S_{\rm n}2$ reactions of the same alky habite will give different products constitutions, isomers)

For earing let he as got and of obtained when 2-broad 3-methy linearing undergoes $S_{0,1}$ reaction is different than expected

The major product results from the rearrangement of carbocassen. The carbocation autially formed can rearrange to a more stable carbocation if the structure of a ky group perms s. This occurs either ti co gi, a hydride shuft H the movement of a hydrogen atom with its bonding pair of electrons are a **methyl shift** H_a , be movement of a methyl group with its bonding pair of electrons. For example, the above reaction may be represented as

Major product

 3° -carbocation rearranges to 3° -carbocation because 3° -carbocation is mark etable than 3° -carbocation. This is called 1,2-hydride shift

Thus the product order when 2-brond-3-meany because undergoon $S_{n,i}$ resolves to different from the product

Sundarly when 3 frame-2 2-comethylbut he is treated with CH in under conditions that fove it S₀1 reaction, the product formed in different from the one expected.

(Only product)

This is because of 1, 2-methyl shift as shown below ,

$$CH_{0} \quad CH_{0} \quad CH_{0} \quad CH_{0}$$

$$CH_{0} \quad CH_{1} \quad CH_{1} \quad CH_{2} \quad CH_{3} \quad CH_{4} \quad CH_{4} \quad CH_{5} \quad CH_{5} \quad CH_{5}$$

$$CH_{0} \quad CH_{0} \quad CH_{1} \quad CH_{2} \quad CH_{3} \quad CH_{4} \quad CH_{5} \quad C$$



The 3° carbocation rearranges to 3°-carbocation because 3° carbocation is more stable than 3°-carbocation. This is called 1,2-methyl shift. Thus, if structure permits rearrangement of carbocations occurs in such a way that a less stable carbocation is converted into a more stable carbocation.

Corclading note. When a reaction forms a carbocation intermediate, always check for the possibility of a carbocation rearrangement.

Reactivity of alkyl halides towards Syl reaction

The over of reactivity depends apon the stability of carbocation in the first step. Greater the stability of the carbocation, greater will be the case of formation from a kyl valide and hence faster will be the rate of the reaction. As we know 3° carbocation is most stable, therefore, the ext-alkyl hances will undergo $S_{\rm N}$ 1 reaction very fast. The order of reactivity will be

tertsary alkyl halide a secondary alkyl halide a primary alkyl halide a methyl halide

For example at has been observed that the reaction $CH_{3/6}CBr$ with ωH^* for a give 2-methyl-2-propanol is about 1 million times as fast as the corresponding reaction of the methyl bromide to give inethanol

	$\mathrm{CH_{3}})_{3}\mathrm{CBr}$	(CH _{a'z} CHBr	CH ₂ CH ₂ Br	CH ₂ Br	
Relative rate (S _N 1)	1.2×10^{6}	12 /	1.1	1	

Thus, the reactivity by $S_N1 \approx S_N2$ follows as

S_N1 meresare

Thus, the primary alky-habides always react predominantly by $S_{n}2$ mechanism—in the other hand, the tertiony alkyl habides react predominantly by $S_{n}1$ mechanism. Secondary alkyl habides may react by either mechanism or by both the mechanisms without much preference depending upon the nature of the nucleophile and solvent

It may be noted that primary allylic and primary brazilia halides show higher reactivity in S_y1 mechanism that a other primary ality and desizyla corbocasion intermediates formed by resonance.

Resonance stabilization of benzylic carbocation

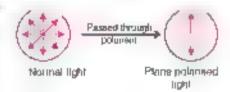
Some Basic Concepts about Optical Activity and Optical Isomerism

The stereochemistry ways a significant role in inderstanding the mechanisms of nucleoph, a substitution teactions. For example, a S_{N^*} reaction proceeds with complete stereochemical inversion of configuration while a S_{N^*} reaction proceeds with recommendation.

To understand these concepts, let us earn about some basic stereochemica, principles and the terms community used.

Plane Polarised Light and Option! Activity

A beam of ordinary light consists of electromagnetic waves vibrating in air planes perpendicular to the direction of light. When ordinary light is passed through a most prism, a special type of prism made of crysta line calcium carbonates, the light emerging out of m, consists of rays vibrating in one plane only. Such a beam of light which consists of waves of light vibrating in one plane only is called plane potansed light. In the prism, the vibrations in all other planes except in one plane are cut off. The most prism used in make ordinary light into plane polarised light is called **polariser**.

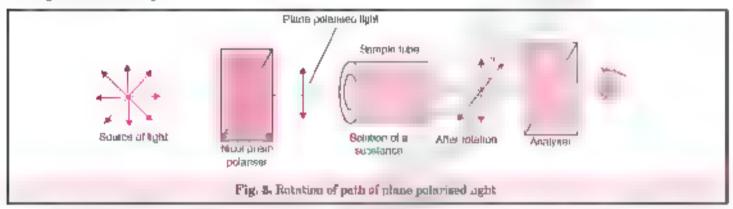


Optical activity

When the solutions of certain organic compounds such as sugar, campuor are placed in the path of a plane polarised light either to the left or to the right. Not all the organic substances rotate the plane polarised light. The sobstances which rotate the plane polarised light are called optically notive substances. The common examples are lactic and tartaric and glucose fraction etc. The substances which is not rotate the plane of the polarised light are called optically inactive substances.

This properly of a substance to rotate the plane of polarised light towards right or towards left is called optical activity.

All optically active substances do not rotate the plane of polarised light to the same direction. Some rotate the plane of the polarised light to the right clockwises while some rotate that is left outs-riocks as. The lighest on and the magnitude of the rotation of plane of the polarised light by a substance is measured with the help of an instrument called polariseter (Fig. 3).



The polarimeter consists of a light source, two raced prisons and the sample tube to hold the substance. The prism placed near the source of light is lained polariser while the other placed near the eye is called **analyser**.

The squeous solution of the substance under investigation as placed in the sample table placed between the polariser and the analyser. The polariser sample tube and and there are arranged in such a way that the light after passing through polariser sample tube and the aim view readless our eye. When the tube is empty, we observe that maximum amount of light reaches our eyes. If we rotate the scalyser which is nearer to our eyes, we observe that tight gets dim and reaches a minimum when the leasus at right angles it its previous position. Let us adjust the leasus of this a maximum amount of light reaches our eyes. Now place the aqueous solution of the substance in the sample tube and observe the effect on the light.

If the substance does not rotate the plane polarized aght, is a said to be optically mactive.

If the substance rotates the plane polarised light at is called optically active substance.

- A substance which retates the reason of xi mased light to the right, a called dextro-rotatory. Latin device = right.
 Such compounds are designated as dear by the sign (+).
- A substance which rotates the plane of polarised light towards the left is called laevo-rotatory Latin, increase—left a Such composeds for designated as for by the again.

For example, actic and which is extracted from include two as related light to the right and hence is known as derive-rotatory inche and an exercise and. On the other hand, 2 methylburas, 1 of which is obtained as a by product of the fermentation of stands, then y alcohol rotates the right to the left and is known as neverotatory 2-methylburan-1-of or -) or i-2-methylbutan-1-of.

Currently dextro and inevo-rotatory rotations are represented by algebraic signs of confection and — for nevo-timatesd of d and L.

Such (+) and -) scomers of a compound are called optical isomers and the phonomenou is termed as optical isomerism.

Specific Rotation

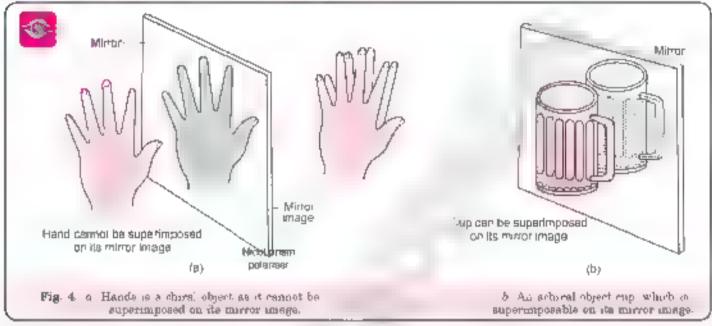
To express optical rotation data it a meaningful way so that comparison can be made, we have fix standard conditions. The optical rotation, thus observed is called **specific rotation**. It is defined as

the number of degrees of rotation observed by L0 g of sample in 1.00 mL of solution in a tube with path length 1.0 decimeler using a D light (569.8 nm wavelength) at a specified temperature.

While reporting specific rotation $[\alpha]$ the wavelength of the light used is given as subscript and the temperature in degrees relation as a superscript. It is also customary to designate the servent and the concentration. For example, $\alpha_{11}^{-15} = -2.25^{\circ} - 0.50$ ethan it means that α was measured at $z5^{\circ}$ C using D-line of sodium and the simple concentration was 0.50 g/mL in ethanol

Molecular Asymmetry and Chirality of Objects and Molecules

In 1848. Lo as Pasteur observed that ervatals of certain's obstances such as sod, im anim mount tartrate exist in two forms which are mirror images. This observation had the foundation of modern stereochemistry. He demonstrated that



aqueous solution of both types of crystals showed optimate our equal in magnitude, for solution of same contentration, in a opposite in direction. He attributed this difference in injuric activity to the three dimensional orrangement of atoms called configurations in two types of crystals.

Dutch scientist, J. Van't Hoff and French scientist C. Le Bell both independently in the same year 1874) pointed out that the four valencies of carbon atom are directed towards the corners of a regular tetrahedron and if all the atoms or groups attached to a carbon atom are different, their such a carbon of on its cated asymmetric carbon atom or stereocentre. The molecule containing asymmetric carbon would tack symmetry and is called asymmetric molecule. This asymmetry of the molecule is responsible for optical activity in compounds. The symmetry and asymmetry are also observed in many day to day objects as discussed below.

All objects or molecules have mirror images.

An object or a molecule which is not superimposable on its mirror image is called chiral.

The most common example of a chiral object is human hand. If we hold our left hand in from of a mirror, the image is its like the right hand of we are a superimpose left and right hands, both paints lower, we observe that the names cannot be superimposed.

Therefore, hands are chiral Similarly gloves shoes, etc are chiral objects. The word chiral ky-ral' a word derived from the Greek word rall rall with means hand is used for those objects which have right handed and self handed forms. The general property of the mediums is called **chirality**. On the other hand, a cup, fork glass tumbler apole a sphere, a cube or a cone are denoted, with their curror images. Therefore, these can be superimposed in their mirror images. Such objects which are superimposed on their mirror images are called **achiral**. Thus

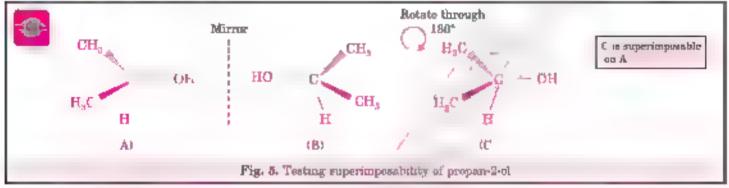
- chiral object has non-superimposable mirror image.
- achira, object has superimposable mirror image.

The same principle of right and left handedness can apply a organic molecules. Though all molecules have immore images on them are some molecules are superimposable on their a roor images, atom for atom. On the other hand, there are some molecules which cannot be superimposed on their moreon images.

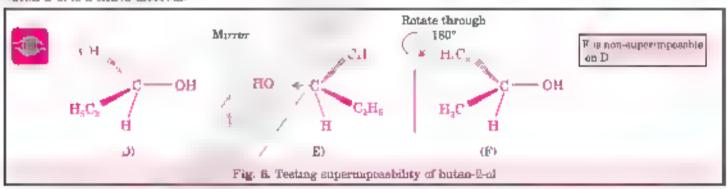
The molecules which are not superimposable on their mirror images are called chiral molecules. The properly of non-superimposability of a structure on its mirror image is called chirality

Let us cest the superimposability of two simple molecules propan-2-ol and butan-2-ol. We do it mentally and examine them by overlap procedure

As a evident, propan-2-ol does not contain an asymmetric carbon, because all the four atoma or groups attached to the carbon are not different. Therefore, it is an arbural molecule. Let us confirm it by the superimposability test. The three dimensional structure of propan-2-ol is shown as A and its mirror image is shown as B. To check the superimposability of B over A, rotate B through 180° in such a way that the C—CH band to the new structure. I projects in the same direction as that in the structure A. Now check structures A and C. We find that A and C are superimposable. Hence propan-2-ol is an actural molecule.



Now consider bulan-2-oi. It contains one asymmetric carbon alon and therefore, it is expected to be a **chiral** molecule. Let us confirm it by superimposability test. The three atmensional structure of butan 2-of a shown as D Its mirror image, a shown in structure E. Now rotate E through 180° in such a way that the C—CH bond in the new structure F projects in the same direction as that in the attricture I. Now try to superimpose Forer I. We observe that D and F are non-superimposable. Fig. 6, no matter how we turn or twist the molecule without breaking the bonds. As shown in Fig. 6. The and H can be superimposed but the spatial orientation of "H₃ and C₂H₅ are different. Therefore, butan-2-of is a chiral molecule.



We can apply the same proved the for 2-chieropropone and 2-chierobutane and examine them whether they are chiral or actural. It can be easily been eved that in 2-chieropropone, the mirror images are superimposable and hence it is actural. On the other are no, the initror into ges of 2-chierobutane are non-superimposable and hence 2-chierobutane as a chiral molecule.

The concept of chirality and achirality can also be illustrated by siphabet letters. For example, alphabet 'P', is chiral received to cannot be superior posed on its increasing the original received to the original receiv

Chirol or Asymmetric Carbon

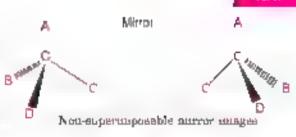
The chirakty in organic compounds was studied by Van't Hoff and Le Bei. He observed that most of the organic compounds winch are chirol at nature have at least one carbon atom which is bonded to four different atoms or group of atoms

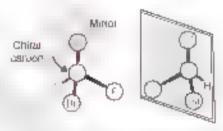
The carbon which is bonded to four different atoms or groups of atoms is railed chiral or asymmetric without symmetry) carbon atom.

It is generally indicated by asterisk as \mathbb{C}^* A modern term for chiral carbon is stereogenic centre or in short a stereocentre. For example consider a hypothesica, molecule CARCT where A, B, C and D are the four different substructive covalently bonded to carbon. If we place this molecule before a ingree it is thereved that it is not a perimposable or, to carror mage. These two non superimposable mirror images represent two isomers or called eanotiomers of the compound

A simple example of a molecule baying asymmetric or chira, carbon is bromoch, rollago methalie. It has not supermisosa de autror mages

Some other examples of molecules having asymmetric or chiral carbon are





Non-superimposable muror images

2-Brumo a chlorobutane

It may be noted that when a molecule con_s as one saymmetric carbon at s always chira. However, the necessary condition for chirality is not just the presence of asymmetri, carbon atoms but the asymmetry of a molecule as a whole-

NOTE

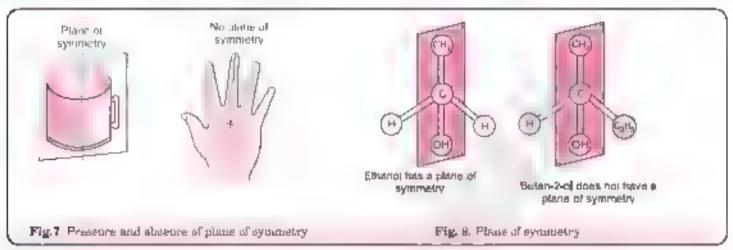
The rediction of chiral or daydimeter of those atom is very easy. We are to only see fittlere is any carbon atom which is bonned of four different at this in groups in the molecule or not. For example, 2 chloroperhane has asymmetric or chiral carbon but 2-chioro-2-met, vipent the does not have asymmetric or chiral carbon.

Dissymmetry and Plane of Symmetry

A molecule that a plane symmetry if an imaginary plane when passed through the molecule bisects the molecule so that half the molecule is the marror image of the other half. In other words, if a plane marror plane) when passed through the molecule fivides the molecule into two symmetrics, haves the molecule is ead to have a piane of symmetry. It is also called a sigma of plane

If we carefully abserve chiral abjects or molecules, it can be observed that these appliedles cannot be divided into two equal and pentical haives. In the other hand, achiral objects or molecules can be easily divided into two equal halves. For example, our is achiral and it can be easily through into two equal halves. Fig. 7. In order words, there is a plane of symmetry. However, to case of a chiral object such as "hand, there is no plane, real or, maginary, which can divide it into two identical halves. Similarly as shown in Fig. 8, an ethanol molecule has a plane of symmetry. This

prone passes through the central carbon atom the CH_3 group and the CH group and bisects the H C CH bond at gree Ch the other hand, chiral molecules at this bittom-less does not have any plane of symmetry. The pione passing through the central carbon atom. CH_3 group and CH group and bisecting the H-C -C H_3 bond angle does not divide the molecule site two identical halves. Thus, there is necessary for any passe of symmetry and therefore, are called dissymmetric. On the other hand, actural molecules have prone of symmetry and are called symmetric.



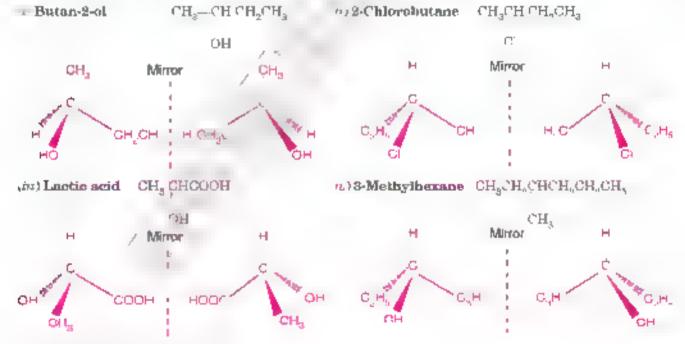
Enantiomers

The fact that butan-2-of molecule and its mirror image connot be superimposed shows that these are two different molecules.

These non superimposable mirror images are called enantiomers.

Thus, the two butan-2-or more tales are exact among it may be noted that enantromers must not only be mirror images, but they must also be non-superimposable.

Similar y Zechharobutane, lacun and Jensetry benedie, en form unreoperimposable matter mages and exist as enaptioners.



Racernic mixtures and racemisation

An equimator menture of the enanthomers destro and toevo forms as called **racemic mixture**. It may be represented as d_i or \pm forms and will be optically markive. The process of converting d_i or d_i form of an optically active compound into racemic form: d_i is called recommendation. For example, on mixing equal amounts of + and 2-chlorobutume, we get ± 2 -chlorobutume racemic inixture. It will have zero optical rotation because the rotation due to one isomer will be cancelled by the rotation due to the other.

Resolution

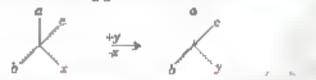
The process of separation of a merical authors into dear sforms engineers is called resolution. However whenever an optically active compound is synthesised in the laboratory, the product formed in most of the cases is a receive mixture and thus, optically mactive. This is due to the fact that there are equal chances of the formation of the deand sforms. In the lationary, the physical separation of a receive mixture, we resolution is not easy. Since the pair of enantiomers exhibit the same chemical and physical properties, they cannot be separated by ordinary physical or chemical methods. One of the most common methods is to allow a receive mixture to react with an enantioner of some other compound. This changes a receive form into a mixture of diasteromers which have different melting and boiling points and solubilities. Then these can be separated from one another by usual methods of separation of compounds. The separated diasteroes some is their broken flows to give pure enasticines.

Retention

Whenever a chemical reaction is carried out on a chiral molecule, the product may have the same configuration as the reaction or may have the opposite configuration. If the relative spatial arrangement of bonds at an asymmetric centre in a chiral molecule remains the same before and after the reaction, the reaction is said to both with retention of configuration means the preservation of a tegrity of the spatial arrangement.

of honds at an asymmetric centre during a chemical reaction or cransformation.

For example, consider the following general reaction.



Sterensmuere are namen secondary

steremanners are named structing to two systems: It and L system and R and w system For dulus refer Competition File (page 118)

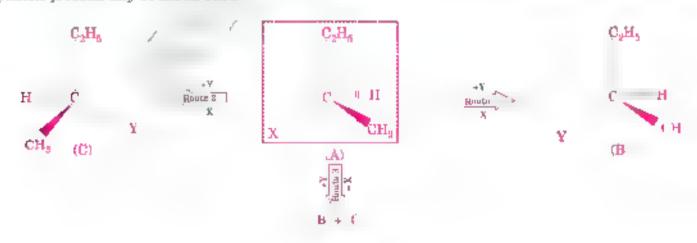
In this reaction, there is retent in of configuration because the relative configurations of the atoms b is and c is same (i.e. clockwise from b to c) both in the reaction b.

as well in the product. In general, fiduring a reaction no bond to the stereocentre is broken the product or have the stand general on figuration of the groups around the stereocentre as that of the reaction. Such a reaction is said to proceed with retention of configuration. For example, when the small visibutant 1-olds a heated with concentrated HCI +> 1-chioro-2-methylbutane is formed.

During the reaction, no bond at the asymmetric centre is broker: therefore, the reaction proceeds with retent in of configuration even though the sign of optical rotation, assigning from $-\omega +$

Outcomes of a Reaction. Inverse of retention and except sation.

When a chemical reaction involves bond cleavage or bond formation at an asymmetric carbon atom, three different products may be formed. For extrapped oring the substitution of a group X by Y in the following reaction, the three possible products may be shown below



If B is the only product, the process is easied retention of configuration because B has the same configuration as the starting resciant A.

is If C is the only product, the process is called inversion of configuration because C has the configuration opposite to the starting reactant A.

If an e_1 amount maxime of B and C i.e., a 60° 60 max we is formed, then the process is called **recemisation** and the product is **optically macrive** because one somer will rotate light in the direction opposite to another

Stereochemical Aspects of Nucleophilic Substitution Reactions

ta: Stereochemical aspects of \$.2 reaction

As we have earnt in S_N^2 mechanism, the attack of nucleophile. CH occurs at the rear side of the molecule relative to the halogen atom. In other words. OH group has not taken the position previously occupied by the halogen atom but on the side opposite to one where the halogen atom is present. As a result S_N^2 resolutions are always accompanied by aversion if configuration in mach the same way as an uncrease is turned at some out at a strong what. This process is called inversion of configuration or Walder inversion. Thus, in case of optically active alky halide, the product obtained has an inversion of configuration of there is change at sign of rotation from + to + and vice versa. For example + +2-bromooctane on treatment with squeous K_n H solution gives ++octan-2-ol as the product

$$H$$
 H_0
 H_0

Thus, $8\sqrt{2}$ reactions of optically active alkyl halides are accompanied by inversion of configuration.

(b) Stereochemical aspects of S_N1 reaction.

In case of optically active alkyl halide, the product obtained during 8., I reaction is a recemic mixture. This is occause the intermediate carbocation forced in the slow step is planar (achiral, species. Therefore, the attack of the nucleophile CH into can take place with equal case from both the faces from and rear forming a mixture of two enantioners. In one enantioner, the nucleophile occupies the same position as originally low qued by the halogen atom while in the other enantioner the nucleophile occupies the position opposite to that of the halogen atom. As a result 50 is 50 mixture of the two enantioners. Jamos and destroins formed. Therefore, the product formed is a recemic mixture in which is optically inactive.

Thus, $S_{\rm v}1$ reactions of optically active alkyl halides are accompanied by recommentum.

For example, hydro value of α_i and a active 2-bromobutane results in the formation of receive matrices $s\pm \nu$ button 3-of

GUM UP

S.2 Reaction

- Nucleophile attacks from book side of X
- Bimolecular reaction involving both nucleophile and alkyl hande
- Second order reaction, rate = k[RX][Nu^{*}].
- Reactivity : CH₂X > 1" > 2" > 3"
- Stereochemistry : inversion of configuration

$$S_{\sqrt{1}}$$
 Renotion
 $R_3C - X \xrightarrow{\text{plane}} (R_3C^*] \xrightarrow{\text{No.}} R_3C - \text{No.}$

- Forms carbocation which is attacked by nucleophile
- Unimolecular reaction now your puty R₂CX asserted
- First order reaction, rate = k[RX]
- Reactivity 3° > 2° > 1°.
- Stereochemistry Racemisation

For a given alky group, the reactivity of the halide, R-X follows , r same order in both the mechanisms rR-1 > R-Br > R-C) > R F

 $\mathbf{S_{N}2}$ • Profic solvenus decrease the race of $\mathbf{S_{N}2}$ reaction but polar appoint solvents increase the rate of $\mathbf{S_{N}2}$ reaction. Sat . Polar solvents increase the rote of Sat reaction because these stabilize the intermediate carbonation.

Protte and Aprotte Solvents

- The solvents from which protons H* ions can be derived are called protic or protonic solvents. Therefore. these solvents curtain ionisable hydrogen. H * Common examples are water. H $_{\odot}$ acids, H $_{\circ}$ S $_{\circ}$ alcohols, etc.
- The solvents from which protons H* and cannot be ordinary derived are caused apratic for non-protonic solvents. Therefore, these solvenus do not contain populable bydrogen. H. Common examples are benzene C_0H_0 carbon setrachioride CC_4 chloroform. H. i., acetomicile CH_0 N. dimethyl formamide DMF. dimethyl sulphomide (DMSO), scetone 'CH₀COCH₀) atc.

B. Elimination Reactions (Dehydrohalogenation)

When topositiones with \$\textit{\$-}\text{hydrogen stom} are solved with accordage so their of potassium rydroxide, they undergo elimination of hydrogen hande. HX, see the gan the formation of alkenes.

These reactions are called $oldsymbol{eta}$ -n $oldsymbol{ ext{min}}$ in alkane the hydroger, atom present at $oldsymbol{eta}$ -position of he halkane e at the carbon atom next fifth t which carries the laloger is removed.

Similarly 1 chromototane on enumerical gives but rene and 2-chiero-2-methylpropane on elimination gives 2-methylpropene

Such reactions are also called dehydrohalogenation removal of hydrogen halide reactions. The elimination reaction occurs by a struction of proton from a carbon atom next to the corbon beaming halogen atom -railed β-hydrogen, and a babde ion is also lost resulting a new **z**-bond as

(where B = Base and X = Leaving group

If there are two or more possibioties, unxtures of products may be formed. For example,

Many compounds can eliminate in more than one way to give a mixture of products. In case a haloalkane can eliminate hydrogen halide in two different ways, then that alliene will be preferred in which earbon along joined by the double bond are maximum alkylated we contain argen number of alkyl groups. The rule is called Saytzeff's rule after the name of Russian chemist Alexan her Zanney also pronounced as Saytzeff) who in 1875 formulated this rule. For example,

NOTE

Cis. trans isomerism of Saytzeff products. If the substituted alkene formed during elimination is capable of showing visitinus isomerism. If it is mis-nikene is a ways preferably formed as the major product occurse of its greater stability. For example,

Ease of debydrobalogenation

According to Saytes Turn's the allrene with greater number of alkyl groups. As most substrated albene, a the preferred product during dehydrohologenation of alkyl habde because it is formed faster than the other askene. Ease of formation of alkenes.

$$\mathbf{R}_{s}\mathbf{C} = \mathbf{C}\mathbf{R}_{s} \Rightarrow \mathbf{R}_{sc} = \mathbf{C}\mathbf{H}\mathbf{R} \Rightarrow \mathbf{R}_{s}\mathbf{C} = \mathbf{C}\mathbf{H}_{sc} \Rightarrow \mathbf{R}\mathbf{C}\mathbf{H} = \mathbf{C}\mathbf{H}_{sc}$$

The stability of alkenes follows the same sequence "bue, we can say that the more stable the alkene, the faster it is formed

In the light of Saytzeff's rule, any alkyl bande which gives a more stable we more highly substituted attend in at undergo denydrohatogenation reaction faster than the one which gives a less stable we has ingley

-18/59-

substituted) alkene. For example, consider the dehydrohologenation of bromoethene, 1° , 2-bromopropane, 1° and 2-methyt-2-bromopropane, 3°

CH. CH,-CH,Br CH.—CH—CH. Brumoethane Hr 2-Втиморгорапе 2-Mathyi-2-bromopropane alc KOH, Heat ale KOH Hoat ale KOH. Heat CH, CH₃CH=CH₆ $CH_n = CH$. $CH_1 - C = CH_1$ 'Mona substituted alkeno) /Unsubstituted offurne Disubst ruted alkener post scable, loset eselly More stable, more easily Most stable, most enably formed formed bearol

Thus, the case of lengthrough genation of these three alky handes follow the order Z-Methyl-Z-bromopropane > 2-Bromopropane > Bromoethane

In general,

The rearriedy of halomkures towards in minimum markon i.e. east of dehydrohatogens, on follows the order tertiary (3°) > secondary (3°) > primary (1°)

For a given alkyl group, the order of reactivity is

RJi < hBr < Rl

It may be noted that are charac KOH courses elimination in the molecule of naroalkane while an equeous solution of the base leads to substitution. In equeous medium, the base locates to give (\cdot, H) may which can act as nucleophile and bring about the outleophile substitution. In aqueous medium, these one also take up water molecules and get hydrated. The hydrated ion is not to a position to abstract a proton from the β -carbon atom and therefore, the elimination does not occur.

Elimination versus Substitution

We have seen that alkyl habdes undergo substitution and elimination reactions. When another atom replaces the habde ion, the reaction is a substitution whereas when habde ion leaves with another atom or ion often H the reaction is elimination. Stiles if any, and elimination, often compete with each other. Most bases are also it releasing to the reaction of the reaction of elimination depending upon the alityl name and the reaction models as As. By having want for ydrogen atom when reacted with a base of an interpolate mast we competing to the subsoit upon Sign of base or nucleophile and reaction conditions. For example, a bulkier nucleophile will prefer to act as a base and abstract a proton rather than approach a tetrahedral carbon because of ateric hindrance and vice versa. For example, when 2-bromopropane is treated with a bulkier nucleophile such as potabilism tert-butonide elimination occurs to form an alkene. On the other hand, when it is treated with a smaller nucleophile such as OH, too, substitution occurs to form an alkene.

2. Втоторгороде

Similarly a primary alkyl habite will prefer $S_{\rm N}2$ reaction because primary carbulation are not very atable. On the other hand, a secondary alkyl halds can undergo $S_{\rm N}2$ or elimination reaction acceptance upon the strength of base or nacteoplate while a termary alkyl hands may undergo $S_{\rm N}2$ or elimination, depositing upon the strongth of carbocation or the more substituted alkene.

In general characteristics reactions require higher temperatures that substitute in reactions. This is recoise arger number of conds are broken in characteristics reactions as compared a substitution reactions in which only one bond is broken. As a result, the activation energy of commutation reactions is greater than that of substitution reactions.

C. Reactions with Active Metals

Active metals ake softam, magnesium codmium, atham, etc., readily combine with alkyl chlorides, bromides and solides to give compoundation from a propoundation of the compoundation of the compoundat

or Action with magnesium formation of Grigmard reagents. When a solution of an alkyl nande in dry ether is treated with magnesium on orkyl outgressium handle a fort, st.

Alkyl magness un handes, generally represent a Los RMgX, are important class of organometa in compounds and are known as **Grignord rengents**. These were discovered by Victor originard, a French chemist to 1900 and are named after his name. For this inscovery Grign and get the Nome Prize in chemistry in 1912. These compounds have great synthetic applications and are useful in the preparation of a large number of organic compounds.

Vinyl and aryl habdes also form Grignard reagents.

In the Grignaro reagent, the car enter green in bend is covalent but highly polar with carbon pulling electrons from electropositive magnesium. This is because of large electronegativity difference between carbon 1.5 or 1 magnesium 1.2. The ring essentially locus Thus Grignard reagents may be represented as

These Grignard reagents are very reactive compounds. They react with any source of proton to form hydrocarbon. Even weakly study into sounds each as water another, mannes terminal alligness etc react with Engineric reagent to give corresponding hydrocarbon.

where Z may be GH/RO, NH_{ν}/RNH , RA = 0, etc.

Therefore, a is very necessary to avoid even traces of moisture from a sugmard reagent during its preparation. These size react read, y with oxygen and carbon doxide. Therefore, these should be prepared and used in the absence of air under inert atmosphere.

II) Action with sodium. Two molecules of alkyl helides same or different react with metallic sodium in the presence of ether to form alkanes. This reaction is called Wurtz reaction and is used to prepare symmetrical aikanes.

$$R = X + (Nx + N) R = \frac{3x}{2} = \frac{3}{2} R = R = + (2Nx) X$$

e.g.
$$CH_{3}$$
 Br + $2Na$ + Br $-CH_{4}$ Bry enter CH_{3} CH + $2NaBr$ Methy, brounde CH_{3} CH + $2Na$ + Br $-CH_{4}$ CH a Bry extere CH_{3} CH a CH a

This reaction generally fans with tertany alkyl handes because under the basic conditions of the reaction, they prefer to undergo dehydrohalogenation to form alkenes.

When a mixture of two different alkyl halides are used, all the three possible alkanes are formed

$$R^{1}X + R^{3}X + 2Na$$
 $\xrightarrow{Depender}$ $R^{1}R^{1} + R^{2}R^{3} + R^{1}R^{2} + NaX$

For example.

$$\mathrm{CH_{3}Br} + \mathrm{CH_{4}CH_{5}Br} = \frac{\mathrm{Ns_{4}}\mathrm{Jipy\,eloust}}{\mathrm{Ns_{4}}\mathrm{Jipy\,eloust}} = \mathrm{H_{5}CH_{5}} + \mathrm{CH_{5}} + \mathrm{CH_{5$$

(fix Reaction with other active metals (formation of organometalite compounds). In addition to magnesium and sockum: haloo kanes also reset with other active metals such its hithium zone mercury lead, etc. if the presence of dry ether to form the corresponding organometallic compounds. For example,

Tetraethyl lead (TEL) is used as an any someting agent in gasoline ised for running automobiles.

Alkyl bithrams have chemistry sum at to that of alkyl magnesium halides. One of the most valuable reactions of alkyl lithrams are hear use in preparing attracts diagranocopper compounds it, also one of silman congents. These reagents are easily prepared by the reaction of an alive attracts with alkyl chlorides, brounds and oddes forming a hydrocarbon product in this reaction, the alkyl group of falmon reagent replaces the halidgen of the alkyl helide forming a new carbon period and and preiding a hydrocarbon product.

Recordly Corey and House suggested a method for preparing symmetrics' and insymmetrics' alkanes. This method is known as they House read to accomplete the coupling of the alky-groups of two siky-handes to produce at aikane $R - X + R - X \rightarrow R - R$. Hand R may be some or different)

In this method, one alkyt muide is first converted into bilinum dialkyl copper and then treated with other alkyl malde. For example

It may be unted that the a kyl balide must be either a methyl haude or a primary alkyl halide. The two alkyl groups being coupled may not be different.

D. Reduction

Haloalkanes are red red to corresponding alkanes by a variety of reagents

. With hydrogen in the presence of a metal catalyst such as a their particular or plantium

$$CH_3CH_aBr + H_a = \frac{N_1 \text{ or } Pd}{625 \text{ K}} \rightarrow CH_3CH_g + HBr$$

Edishe

(a) With zine copper couple and ethyl alcohol 195%.

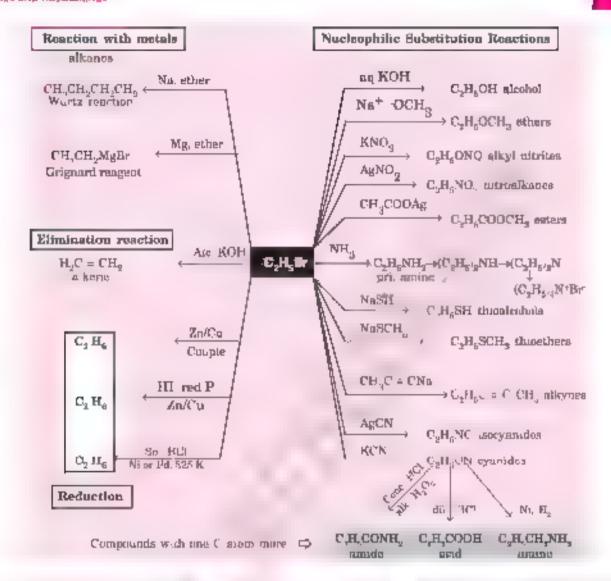
(in) Hydroiodic acid in the presence of red phosphorus

Reduction of haloalkanes can also be carried out by Zn/HCL Sn/HCL LiAiH, (Libium aluminum hydride) or NaBH, (sodium borohydride).

E. Reargangement

When a haloalkane is heated at 578K or at a lower temperature to the presence of anhydrous olumns an obligade as catalyst, the haloalkane undergoes rearrangement to form is onerto haloalkane. This reaction is called isomerism

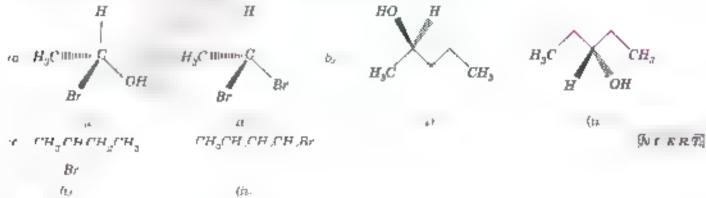
If there is no hydrogen atom on the carbon atom adjacent to the C—X group rearrangement occurs in which methyl group interacts. For example,



SOLVED EXAMPLES

Example 11.

Identify chiral and achiral molecules in each of the following pairs of compounds



So. atron.

- In structure the central carbon stones bonded to four different substituents. H. OH. Br and CH₃ and hence is charal.
 Structure has two identical Br atoms actioned to central carbon atom and hence it is achiral molecule.
- b) (c) is chiral and in its schiral.
- c) (c) is chiral and a is achiral.

Example 12...

far Identify the chiral molecule in the following



A.I.S.B. 2014

(D.S.B. 2014 D.S.B. 2014

16. Which alkyl hande from the following pair is chimil and undergoes faster \$.,2 markon?



(c) Out of Sal and Sa2, which reaction occurs with

(i) Inversion of configuration
(ii) Recemisation

'ds Identify the chiral molecule in the following pour



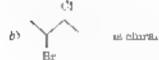
(A.I.S.B. 2018)

(a) Write he structure of arbene formed by dehydrohologenation of 1 brains 1-methylcyclohoxano with alcoholic KCH ALS.B 2018⁵

So, atron.

(a)

2-chlorobutane ia a chural molemula



A 1. 0 a

(6) S..1

 Bromo-i methyl cyclobenane

Example 13.

60

Complete the following reactions: guing major products;

to
$$CH_ACH_aCNOAB$$
 Br_2 , no KOH .

(b) f $P.Br_3$ CH_ACHCH_3 ale KOH g HBr Furantic Br

(e)
$$CH_3CH_2CH_2CI$$
 $CH_3C=CNa$

(d)
$$\langle D.S.H. 2014 \rangle$$
 $\langle D.S.H. 2014 \rangle$

(e)
$$CH_{\beta}CHI = \frac{Na}{Dryethet}$$

Example 14...

Predict the order of reactivity of the following compounds in $S_{ij}I$ and $S_{ij}I$ reactions ta. The four isomeric bromobutanes

Ethene

 $b = C_a H_a C H_a B t = C_a H_a C H^a C H_b B t$, $C_a H_a C H^a C H_b = C_a H_a C + C_a H_a C H_b B t$

N.C. K.R.T.

a The four isomeric bromobutanes are

g. CH, CH, Br + KOH are a

OH, CHCHCH, Br & CH, CHCH, CHCH, or CH, C—Br 'H, c'H, C'H, c H, Br CH.

 $+ CH_0 = CH_0 + KB_1 + H_0 T$

in Sml reactions, the order of reacting depends upon the stability of the intermediate carbocations. Since the stability of correction decreases as $3>2^{\circ}>$. The order of reactivity also decreases in the same arrier - and v are premary alsylving vandes but the corboration intermediate denoed from CH_2 , CHCH, Br is more stable than that derived from $\mathrm{CH}_2\mathrm{CH}_3\mathrm{CH}_4\mathrm{CH}$ Br because of greater electron damaging inductive effect of (CH, 9CH group Therefore. "Hy CHCH, Br is more resouve man in a secondary and is is tertiary bromide. Hence the order of reactivity in Squ H.CH.CH., 'H.Br in Syr, reactions #RHPMON 16

 $CH_aCH_aCH_bCH_bBr < (CH_{a'a}CHCH_bBr < CH_aCH_bCH(Br)CH_a < (CH_{a'a}CBr)$

The reactivity in $S_{
m K}2$ reactions follows the reverse order as the steme andrance around the electrophilic carbon increases mthat order. Thus, the order of reactivity in $\mathbf{S}_{\mathbf{k}}\mathbf{Z}$ reactions is $CH_aCH_bCH_aCH_bBr > CH_{a/a}CH - H_aBr > CH_aCH_bCH_bBr(CH_a > C'H_{a/a}CBr$

 δ In $S_{m,k}$ reactions. The reaction by increases with increase in stability of the intermediate carbocations formed as $S^* \geq 2^* > 1^*$ Therefore $C_1H_2X_1H_3H_3$ By which gives 3° conhocolator $x\in C_3H_3$ is the most reartive. Of the two equandary aroundes, $C_gH_g CH_1 \stackrel{!}{>} H_g$ Br and $\stackrel{!}{>} H_g$ Hi. $^{!} H_g / Br$ the corbocation incorporate obtained from $C_gH_g CH_1 \stackrel{!}{>} H_g / Br$ i.e., $C_{gr - g} \subset I \stackrel{!}{>} G I_{1g}$ is more stable than that obtained from $C_sH_sCHrCH_s/Hr=\kappa=_gH_sC_rrecH_0$ because it is stabilised by two phenyl groups due to resonance Therefore, $C_aH_aCH(C_aH_a)Br$ is more reactive than $C_aH_aCH(CH_a)$. Br

The fourth alkyl bromide is $C_aH_a\cap H_a$ Br which gives primary carbocation is $C_aH_a\cap H_a^+$ is least reactive. Hence, the overall reactivity of these alkyl bromides towards $S_{n}1$ reactions decreases as:

For S₁₂1 reaction: C₂H₁CiCH₂ C₂H₂ Br > T₂H₂CH C₂H₂ Br > C₄H₅ TH CH₄ Br > C₄H₅ TH₆ Br

In Sign reactions, the reactivity depends upon the steme hinterance and decreases as $8^\circ < 2^\circ < 1^\circ$. Therefore, primary bromide, C_8H_8 C_8H_8 C_8H_8 is most reactive and verticity bromide C_8H_8 C_8H_8 C

For $S_{ij}2$ resotion C_gH_g CVCH $_g$ C_gH_g Br $< C_gH_g$ CH C_gH_g Br $< C_gH_g$ CH CH $_g$ Br $< C_gH_g$ CH $_g$ Br

■ Example 16...

to in the following pairs of the halogen compounds, which would undergo $S_{n}2$ faster ℓ

'b Which one of the following pairs undergoes S_N1 substitution ream on fineer and why?

50. alice of $S_{\rm p}2$ reaction proceeds through the formation of a transition state involving bonding of carbon to five atoms or groups. The reactivity is decided by stability of transition state on the basis of stand hadrance. The reactivity follows the order $CH_{\rm p} > 1^\circ > 2^\circ > 3^\circ$ balids. Therefore,

CH_cCl is primary elkyl bande and beaus undergoes S_{pl} reaction faster

I will undergo $S_{\rm w}2$ reaction faster seen as induce is a better leaving group because of its large size and bence it will be relocated at a faster rate in the presence of insuring aucknowledge.

- Br 1 Bromo-2 2-dimethylpen was reacts faster because it is 1° alkyl halide
- 20 April 2 Methyl-1 bromopropine reserve faster because it has resser eteric bandrance in the transition searce
- $v=144,\,\mathrm{CH_{2}}$ Br would undergo $\mathrm{S_{2}2}$ reaction finiter because of less steric handrance

more stable than each ocation. 1") obtained from CH, CH, Br

 δ S_N1 reaction occurs through the forms into of varbocation. Therefore greater the stability of the carbocation, faster is the rate of S_N1 reaction. Since the stability of varbocation follows the order $3^{\circ} \times 2^{\circ} \times 1^{\circ} \times 1^{\circ}$, herefore,

■ Example 10...

Which compound in each of the following pairs with react faster in Sig-Preachon with GH^{-2}

$$CH_2 = CHBr$$
 or $CH_2 = CH - CH_3Br$

■ Example 17_m

Predict the order of reactivity of the forouring compounds in dehydrohalogenation

- TO CHACH BO CHE CHECHER CHER CHEST CHEST CHEST CHEST

b) $CH_{\bullet}CH_{\bullet}Br > (CH_{\bullet})_{\bullet}CCH_{\bullet}Br > (CH_{\bullet})_{\bullet}CHCH_{\bullet}Br > CH_{\bullet}CH_{\bullet}CH_{\bullet}Br$

A vidora derivative. A lon treatment with zinc copper rouple gives a hymmic from B, for high rarban atoms. When A is dissolved in other and treated with sodium 2, 2, 5, 5 tetramethylhexage is formed. What is the formula of the

Solution. The structural formula of 2, 9, 5, 5-tetramethylhexane.

suggests that the compound A which gives the above compound 4 rung Wartz reaction is

The complete sequence of reaction is

1.Chlorn-Z, S-dunekbyl propade

$$CH_1$$
 In/Ca
 CH_2
 CH_3
 CH_4
 CH_5
 CH_6
 CH_6
 CH_7
 CH_8
 $CH_$

What products would you expect from the elem nation of the following arily) handes, which product with be major in PRACT CORRE

3-Broma-2-methylbulane

bolution.

Ú,

$$CH_{a}$$
 CH_{a} CH_{a}

Elimination CH_{a} CH_{a} CH_{a} CH_{a} CH_{a}

2-Brome-2-methylbutane

CH_-CH_ CH_CH_

CH.

(Majur

$$= CH = CH_s + -CH + CH_s$$

- From each of the following priors, predict which compound will have higher brilling point
 - a) nopropyl brounde and a-propyl brunnde
 a) brounethane and indoethane
 - as tert-butyl chromde and cert-bucyl indide a sec-propyl brounds and m-buty- brounds
- Arrange the following in the increasing order of boiling point 11.

 $CH_{a/a}CB_{\Gamma} = a + CH + CH + CH_{a} + CH_{a}CH_{a}CH_{a}CH_{a}CH_{a}B_{\Gamma} = a + CH_{a/a} + CH_{a/a}$

- Which usomer of C. H. Cl will have the inwest boiling point? 12.
- 13. Which metal is used in the preparation of sugmerd's reagan from baloalkanes?
- Which of the following is most reactive alsohol for its reaction with HC ? 14.
- a) (CH_{a/a}COH
- (b) (CH,,,CHCH,OH
- (e) CH_CH, CH CH,

- 15. Name the reagents used to convert
 - a 1-Chinropropane to 1-intropropane & Bromoethane to butane
 - Bromoethane to othoxyethane do Bromoethana to a-busyne
- Bromoethana to diethyl throather

Give chemical reactions

- Select the compound tysin graftmage arrived to the following particle and a constant for the following above to the following particle and the following particle are the following particles and the following particles are the 14% treated with hydrogen brounds
 - 2 1-butanni or 2-butanni
- .a) 2-methyl-1-batanol or 2-butanol
- en 2-methyl-2-butanel or 2-butanel
- Which will be the main product when the following balookkanes are tree oil with alcoholic KOH ? 17
 - 2H_a2H_aCl 2H_{ab}Cl
- Predict as the elkenes that would be formed by the dehydroms remains of the following handes with addition ethorade and 18. identify the major alkene

 - 2-Chloro-2-methylbutane a 2 2 d-trunethyl-3-bromopentane

 - Cydeharyhaethyl bromade r 1-Bromo 1-methyle: clonerane

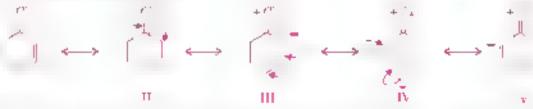
Answers to Practice Problems

- n-propy-bromida (n. iodoethane as tert-but nuclide in-butyt bromida 10.
- 20 < 1 × 0 11
- 'H an X'
- Magnesium. 13.
- 14. 12.
- a AgNO, silver nitrite 15.
- A Natether
- ic Na O C.H. sodium ethonde
- d) NoC = CH (soctium acetylide) (s) sodium sulphide Na₂S)
- (r 2-butanol a 2-butanol m 2-methyl-2-butanol 18.
- is Z-butane in CH_CH = C(CH_a) 17.
- 2-Methylbut-2-ene mnor + 2-methylbut-1-ene 8 4.4 Tranethylpent-2-ene mejor + 2,3,8 tranethylpent 1-ene 18.
 - 44 I methylogolobezhoù smojor methylene cycloheznoù as enoue de . Cent 1 skione

CHEMICAL PROPERTIES OF HALOARENES

Haloarenes are chemically less reactive than haloalkanes. The low reactivity of haloarenes in comparison to halonikanes is due to the following reasons.

 Resonance effect. In haloarenes the electron pairs on the halogen atom are in conjugation with x-electrons. of the ring and the following resonating structures are passible



As a result of resonance, there is delocalisation of electrons on C. C1 bond which acquires a portion to bie bond. character. This is also evident from the contribution of sunctures III. IV and V. As a result, the bond cleavage in



haloarenes is difficult than halosikanes in which carbon is attached to halogen by a pure single bond. Therefore, ha parenes are less reactive towards madeophilic substitution reactions.

2. Difference in hybridisation states of carbon atom in C—X bond. In balcolkanes, the carbon atom of the C—X bond is sp^3 hybridised while in harbarenes, the carbon atom attached to balogen is sp^3 hybridised. The sp^2 hybridised carbon atom with a greater s-character is more electronegative in can hold the electron pair of the bond more rightly than the sp^3 hybrid sed carbon atom in a kyl no idea with less s-character. Therefore, the C—X bond in baloarenes is shorter than in baloarkanes. This is confirmed by X-ray analysis which shows that the C—C bond length in chiorobenzene is 100 pm while the C—C bond length in efficience more cute is 177 pm. The shortening of bond length imparts stability to ary haldes and as a result, the bond cleavage becomes rather difficult. Therefore, he carenes are less reactive that haloalkanes towards nucleophilic substitutions.



4. Instability of phenyl cation. In case of haloareres, the phenyl cation formed as a result of self-ionisation will not be stabilised by resonance becomes the sp^2 hybridised orbits of carbon liesing we charge is perpendicular to the p-orbital of the phenyl ring. Therefore, phenyl cation is not formed and therefore S_N^+ mechanism cannot occur

6. Repulsion between the electron rich attacking nucleophiles and electron each arenes. Do a sec of electron each section each nucleophile will not approach closely for the attack because of repulsion.

Thus, haloarenes are less reactive towards the substitution reactions than baloatkanes. However, under drastic conditions, and its idea undergo at lists than reactions as discussed below

A. Nucleophilic Substitution Reactions

1. Replacement by hydroxy group formation of phenol. On heating anyl handes with aqueous solution of sodium bydruvide at 623 K and under pressure 300 atm. the halogen atom is replaced by hydroxy, group forming phenol. In the first stage sodium phenomias is formed which on andification gives phenol.

This reaction forms the basis of waws process for the manufacture of phenol.

2. Substitution by amino group (formation of ani ine). On heating with aqueous ammonia in the presence of cuprous axide itstayet at 476 K and under a pressure of 60 atmosphere, the halogen atom is replaced by amino group.

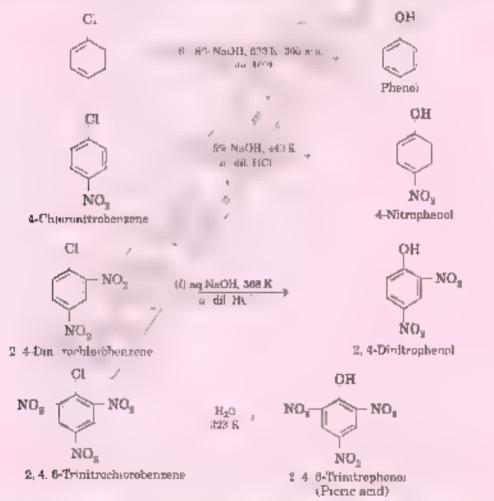
CI
$$NH_2$$

$$2 + 2NH_3 + Cu_5O \xrightarrow{\frac{47}{600}} \frac{K}{800} \xrightarrow{\text{shift}} 2 + Cu_5Oi_2 + H_5O$$

3. Substitution by cyano group (formation of cyanobenzene). In heating with anhydrous cuprous cyanide in the presence of gyndine or dimethy formamide. LMF, the halogen along is replaced by cyano group.

The cyanobeazene can be converted into some other useful compounds. For example,

Effect of substituents in halocrenes (aryl halides) on the mactivity. The presence of certain groups at certain positions of the ring garketly affects the reactivity of to harmes. It is occur observed that the presence of electron withdrawing groups such as —NO_g, —CN. —COOH, etc. at a and prositions to the halogen atom greatly activates the halogen towards nucleophilic substitution renotions. For example, choosier zero is converted into phenol by 3–8% aqueous NsOH only at temperatures above 623 K whereas p-chioromitrobenzens is converted into phenol by aqueous NsOH at 4+3 K. As the new her of ortho and para mate groups on the ring is increased, the reactivity increases.





Explanation for effect of NO, group

The presence of NO, groups at ortho and pure positions withdraws electrons density from the herizone ring and therefore from otes the attack of the aucleophics of haroarenes. The carbamon it is formed a stabilized through resonance as shown below.

It is clear from above sured, resethat it case of ϕ and p-chorobenzenes, one of the resonating structures. It is case of p-naro charobenzene and λ in case of ϕ -charobenzene bears a negative charge on the carbon atom bears g the $-N\Omega_s$ group. Therefore, the carbonous are stabilized by the $-N\Omega_s$ group as well as π -electrons of the herizane ring. However, in case of m-introcharobenzene, none of the resonating structures must be negative charge on carbon atom bearing the $-N\Omega_s$ group. Therefore, the introgroup at must be about does not stabilize the negative charge but the carbonous is stabilized only by the π -electrons of the benzene ring. In other words, the carbonous formed from ϕ -introcharobenzene and p-introcharobenzene are most stable than that formed from m-introcharobenzene

Thus the presence of electron withdrawing groups at a and pipositions (but not at m positions) and hardes towards nucleophical substitution reactions. Moreover, as the number of electron withdrawing groups at a and piposicial increases, the stabilization of the resulting carbanion increases due to more structures of H and V type and hence, the reactions of he ary hadde further increases.

It may be noted that although the presence of AvO, group electron withdrawing group, at in-position wint the notiged does not sto thize the carbanion by resonance effect, it does sto nize it somewhat by the inductive effect as compared to the carbanion resulting from chlorobenzene useli. Therefore, min trachtorobenzene is more reactive than chlorobenzene towards nucleophiaic substitution reactions.

B. Reaction with Metals

Reaction of magnessum. Like sikyl balides, any bromides and indides also react with magnesium in dry
ether to form Granard reagent

Propunde

Chlorobenzene reacts with magnesian in the presence of tetrallydrofuran THF source

Phenyl magnesium

 Reaction with lithram. Brome and indearenes react with attribute metal at the presence of dry ether to form corresponding organometallic compounds.

3. Reaction with sodium.

(r Wurtz Fittig reaction. When anythalide is headed with asky halide in the presence of sodium in anhydrous other, halogen atom is replaced by askyl group. This reaction is replaced by askyl group. This reaction is replaced by askyl group.

(ii Fittig reaction. When haloarenes react what sodium in the presence of ether diphenyl is formed. This reaction is called Fitting reaction.

Reaction with copper powder.

Ulmann reaction, loobenzene when heated with copper powder in a sealed tube. It gives diplically this reaction is called Ulmann reaction in a slaw called Ulmann biaryl synthesis.

C. Reduction

Haloarenes andergo reduction with LiA.H., or make all annualization to the presence of an alkaz to form hydrocarbons. The reduction is brought about by the assecut hydrogen.

D. Rong substitution or electrophilic substitution reactions

Haloarenes undergo electrophilic substitution reactions in the benzene ring. The halogen atom is only and poro directing and therefore, substitution takes place at ortho and para positions.

The orthe and para directing effect of balogen atom, an be understood, if we consider the resonance structures of chlorobenzene as shown below

major

It has been seen that in structures III. IV and V the ortho and para positions get negatively charged. In other words, the electron density is relative a more at ortho and para includes and consequently the incoming electrophile is more akely to attack on these positions. However, because of steric hindrance as the ortho position, the para-product is utily predominates over the ortho product. Firther, it may be noted that an igen atom has. I effect because it is electron withdrawing group. As a result, is ends to describe the benzene ring. Therefore, the electrophical substitution involves of chlorobenzene order story and under dessity roughtman against of the electron. Thus,

- Remember Haloarenes undergo electrophilic substitution reactions alowly as compared to benzene
 - Helogen group is ortho and para director para-product asually predominates over the ortho products.

Some important reactions of chlorobenzene are given below

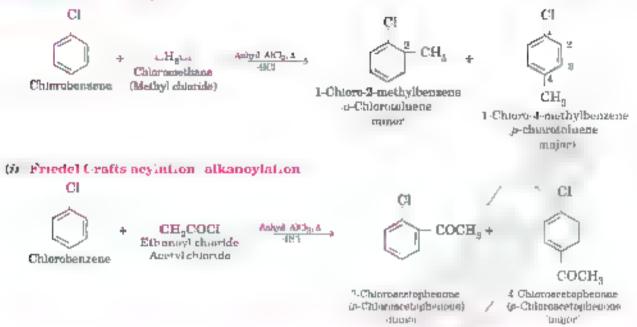
1. Hologenotion. It takes place by reacting haloarenes with halogens in the presence of ferms sait as cutalyst

9. Nitration. It is carried out by heating haloarene with cond. HN x_0 in the presence of cond. HLSC,

3. Suiphonation. It is carried out by besting haloarene with concentrated $H_1\mathrm{SU}_{2}$

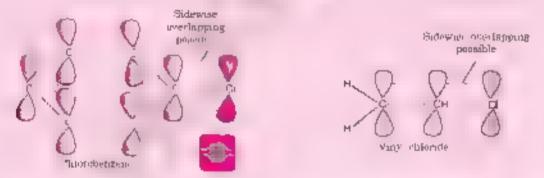
4. Alkylation and acylation or alkanoylation). The reaction knows as Finedel-Crofts reaction, as carried by treating basearene with alkylichloride or acylichloride in the presence of anhydrous aluminum chioride arting as catalyst. For example,

(i) Friedel Crafts alkylotion



Comparison of reactivity of alkyl, vinyl and aryl hair les

Vinyl handes and anyl habdes are less reactive than a ky mondes. This is mainly because the vinyl and anyl handes have partial notices and character between a clion of longer atomic ready theresed for all probables. As a result, carbon bailogen bond of a vinyl or any has ide is stronger than that of an alkyl habde and the bond cleavage is differ it. As a live, below the prorbit of theme atom having a one poor of electrons evertaps with the unhybridised prorbital of carbon in whyl and are halded resulting partial double bond character to C—C1 bond. As a result C agont becomes from a straight or C along any cap at be easyly substitted.



Alternatively it may be inted that vinyl halides and anyl halides generally donot undergo $S_{\rm V}1$ or $S_{\rm V}2$ reactions. This is because

so S_RI renction requires constation to form a viril or anyl carbocation. These are less stable that a kylicarbocation. In amourance and viny mandes the phenyl cation or the vinylic cation formed as a result of self-ionization are highly ansimble and do not form readily. These will not be stabilized by resonance beta self-the sp²-tylard self-orbital of corbital and is sharply cation are perpendicular to the p-property of the phenyl group or the vinyl group. Therefore phenyl cation or vinyl cation are not formed and hence S_RI mechanism cannot occur

S_N2 reach up requires each side attack by the randeophyse, which is not possible in case of vinyl or anylhabities because of repulsion of the electrons in the double bond or aromatic ring.

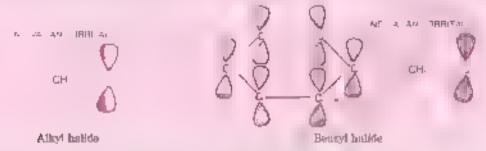


Moreover, they are unreactive in S_N^2 reactions because the carbon-halogen bond of vinylic or phenyl handes is stronger due to double bond character.

$$C = C$$
 or $C = X$ $\rightarrow No. S_N 1$ or $S_N 2$ reaction.

Vinyl balide Aryl halide

However there is no possiblety of double bond character in $\mathbb C$ -balogen bond in alkyl habdes. In benzy adults also, there is a $\mathbb R_n$ -group separating the amogen atom from a $\mathfrak p^2$ hybridised carbon. Therefore, the $\mathbb R$ -portate, of haloger atom $\mathfrak m \mathfrak g$. Circulant week $\mathfrak p$ sidewise with the $\mathfrak m$ -yinglined prophets, of $\mathbb C$ arm. Therefore, the $\mathbb C$ - $\mathbb R^n$ bond is not very strong and can be comy cleaved. The $\mathbb R^n$ -altyl ham so arm benzyl habdes are more rescuive than anyl and anyl handes.



Sidewise overlapping not possible

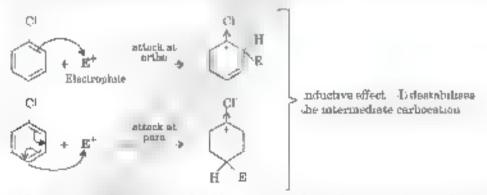
SOLVED EXAMPLÉS

Example 20...

Atthough horne s an electron anthdroning group we if is on the pairs directing in electrophic aroundle substitution reactions. Why

Societion

Charine is an electron withdrawing group and has — industrive effect. Therefore it withdraws electrons from the brazene ring and tends to destabilize the intermediate carbonauton formed during the electrophilic substitution reaction. The intermediate carbonations for ortho- and para- attacks are shown below.



However, the tone pairs of electronic on the chlorine atom stablesse the intermediate carbocation due to resonance

Since I effect of Clus stronger than its +R effect therefore sauses electron withdrawat and this causes not descrivation. The resimings effect sands in approach the industrie effect for a tack it ortho and pure position and hence makes descrivation less for ortho and pure attack. Thus we can say that the rescrivity is controlled by the stronger inductive effect and orientation is controlled by the resonance effect. Thus, although chiorobenzene is less reactive than benzene but it is arthough the resonance affect.

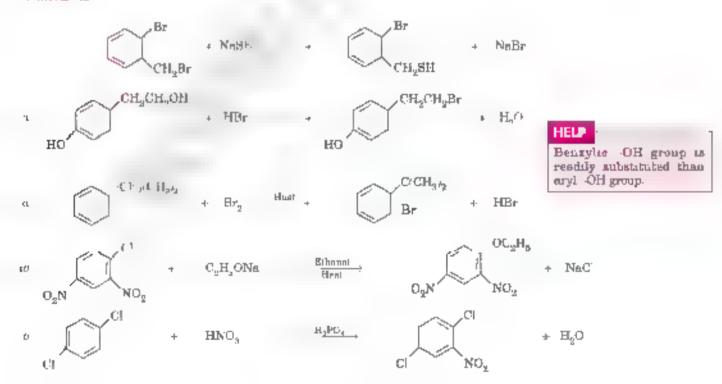
Example 21.

ia. Write the structure of the major product in each of the following

Hr S.R 2018

b Write the structure of the product formed when on probenzene is treated with methyl chioride in the presence of sodium metal and dry either.
(ALS.B. 2018.)

Solution (a



Biber

Diphenyl

$$N_{s}^{*}CI$$
 $Cu_{s}CI_{s}$ CI $+ N_{s}$

 CH^3

Toluene

Practice Problems

19. Which out of o-chloronitrobenzene and 2-4-6-trimtrochlorobenzene is more reactive towards nucleophilic substitution?

CH, + 2NaCl

- 20. Write the structure of diphenyl. How is it prepared from chlorobenzens?
- 34. Which of the following is an arribabile?

C

22. Which of the following will be least reactive towards nactoophilic substitution reaction?

e CH₂CI

b CH₃

۰ (

di (*gH_s.))

- 23. Write the prescrible scomers of the aromatic compound having molecular formula [1,H,1]. Which of these was have weakest C—Ci bond?
- 24. Identify X, Y and Z in the fillinwing reactions

α) ₂H_sNH_s

61

c C_nH_aN_n*Cl

- 25. Give reagents, inorganic or organic compound needed to convert beneyl bromade into
 - e benzyl odide
 - benzyl ethyl ether
 - (s): benzyl alcohol
 - to) beazyl oyanide
 - benzyl acetate
 - er (nitromethyl benzene

26. How are introducrobenzene and discrobenzene sulphonic and are prepared from chlorobenzene? Uttorokhond 5 B 9015

Answers to Practice Problems

18. 2, 4. 8-trimbrochlorobenzene

p-Nitrochlarobenzene

p-Chlorobenzene sutphonic acid

SOME COMMERCIALLY IMPORTANT COMPOUNDS

Carbon compounds containing more than one baiogen atoms are called **polyhologen compounds**. These compounds are useful in industry and agriculture. The uses and environmental effects of some polyhalogens are discussed below

Dichloromethane (methylene chloride), CH_eCl_e

Met, viene chioride is a concress sweet smelling hytad. It is a votable around having low coiling point of 318 K and its specific gravity is 1.37

Uses. > It is used as a solvent in a paint remover and also se a meta, cleaning and finishing solven...

Because of its now boring want and low affiantmability it is on effective solvent for extraction in pharmacentrical in the manufacturing of drugs and food industries

in It is also used as a propellent in serosols.

(iv) It is used as refrigerant and dewaxing agent.

Methylene chloride is known to have **barmful effects** on the human central nervous system. Exposure to low evels of methylene chloride in air can lead to slightly impaired hearing and vision. However exposure to high levels of methylene chloride can cause dizziness, nauses, tingling and numbriess in the fingers and the toes. Moreover in humans direct contact of methylene chloride with skin causes intense burning and mild redness of the skin. Direct contact with the eyes car even burn the cornea, it was observed that the cornea of unumals was duringed when exposed to vapours of methylene chloride.

2. Trichloromethane CHCl, (Chloroform)

Chroroform a prepared in the labora ory by distribute a mixture of ethanoi with a suspension of bleaching powder

CaOCi₂ + H₂O ^{Caidatum} → Ca(OR)₂ + Cl₀ Bleaching powder

nearthing powder

CH₂CH₂OH + Cl₂ → CH₂CHO + 2Hc

It can also be prepared by distalling acetone with preaching powder as

It is a colourless only liquid with a peculiar sickly sinel, and a burning tasse. It is beavier than water. It is sparingly soluble in water but readily soluble it organic solvents such as ethic nor and ethics. It is possonous compound. The vapour when inhaled cause unconsciousness. Due to this reason, chloroform, a used as an anaesthetic.

Chloroform is slowly exactsed into a personous compound phosgene carroiny renorme in the presence of our or light

Since phospens is very possenous. Its presence makes chieroform $unt^{p_{\mu}}$ for use as anaesthetic

Preservation of chloroform. Since chloroform is used for an acculetic in sposes, therefore, its slow and attom to phosper's must be prevented. The following precautions are taken in keep the inform pure.

(i) It is stored in dark coloured bottles to protect it from sunlight

The bottles containing chloroform are completely if ted up to brim and are properly stoppered to keep out our

A small amount of 16 of 1% around a added—the bottles of theoreform. This reacts with phangene that may be formed during samage or numbers maintees distingly carbonaise.

Chloroform reacts with adver powder to give ethyne (acetylene).

$$Cl_3$$
 CH + 6 Ag + CH Cl_3 $\xrightarrow{\Delta}$ CH = CH + 0 AgC1

Uses of chloroform. Chioroform has the following uses

- In undustry chloroform is used as an important solvent particularly for fats, alkaloids, todine, waxes, rubber etc.
- It is used as an anaesthetic But these days it has been replaced by other anaesthetics such as ether, it is very toxic minature.
- 23) It is used as a laboratory reagen.
- (iv) It is used in the preparation of chloropicrin, chicretone, etc.
- It is used in medicines.
- (of) It is used in the production of freon refrigerant, R-22

In the earlier days, chloroform was used as a general ansesthetic in surgery. This is because inhaling chloroform vapours depresses the central nervous system. It has been observed that breathing about 900 parts of chloroform per million parts of air 1900 ppm, for a short time causes dizziness, fatigue and headache. Thronic chloroform exposure may damage lever and kidneys because chloroform is metabolised to possonous phosgene. Some people develop sores when the skin is immersed if chloroform. Therefore the use of lifer domains an amesahetic has been replaced by less toxic and safer ansesthetic such as other

3. Indoform (Tri-iodomethane) CHI_a

I doform is prepared in the laboratory by heating ethanol or acetone with indice and Na₂CO₂ or alk, it solution

$$CH_8CH_4OH + 4I_4 + 6NaOH$$
 $hast + CHI_3 + 5NaI + HCOONa + 5H_4O$
Etherol
Indeferen

$$CH_3COCH_3 + 3L_5 + 2Na_5NO_3$$
 hand $\Rightarrow CHI_3 + 3NaI + CH_3COONa + 2CO_5$
Asstrate Iodoform

lodoform, is a yellow coloured crystal, ne soud with m. p. 192 K having characteristic at pleasant idour.

It is manuable in water but read without residuely a minologic ether. It has an antisepur action the or theretain of free highes

Uses of iodoform. The important uses of iodoform are

- If it is used as an authorptic and this nature is due to free jodgie that it there as aid not due to conoform uself. However, because of its very unplease of size in this now been replaced by other forcementations continuing judges.
 - 2. It is used in the manufacture of pharmaceuticuls.

4. Tetrachloromethane (Carbon tetrachloride) CCl.

Carbon tetrachionde is a colourless only equid with sickly sine. It is insof ble in water but is soluble in organic solvents such as easier a conol. Its boung point is \$50 K. it is inflammable.

Uses. The important uses of CCI, are

- 1 It is used to large quantities in the manufacture of refrigerants and proper anta for aerosol cans.
- 2. It is used as a feedstock in the synthesis of chlorofluorocarbons, freons, and older chemicals.
- 9. It is used as a solvent for the manufacture of pharmaceuticals.
- 4. At is used as a solvent for oils. lats, waxes, etc.
- 5. It is used as a fire extanguisher under the name pyrene
- 6. It is used in dry cleaning.

Until the mid-1960s, carbon tetrachloride was widely used as a ricining 0 sid, both in industry, as a degressing agent, and in the home, as a spot remover and as fire exchangua, ser the most common effects are discussed that exposure to carbon letrachloride causes byer cancer in auto- s. The most common effects are discussed, lightheadeness nauses and comming which can cause permanent damage to nerve caus. In severe cases, these effects can lead rapidly to stupor taxiness, come unconsciousness or even each.

Exists or the carbon tetrachiorade valuouss can make hereal teat arregularly or even may stop it. When prought in contact with eyes, it may cause arritation in eyes.

It has one damaging effect an environment. When rather etrachionide is released into air, it may be at the atmosphere of the property and the open investment the bound exposure a ultraspect radiations. When may lead to increased akin concerneye the bounders and possible have property of the number system.

5. Freens

The chare fluor compounds of methods and its metre collectively known as freens. These are extremely stable too braing non-tall animable, non-town, ton-conserve easily bruefishle and highly careactive compounds. There are stable even to be tagh pressures as the permutes and therefore, find use as refrigered as Among bese to the fluorimetowne CC. F. known as Freen 1 as the most important compound of this has been an industrial uses 1, is manufactured by the action a animony fluoride on carbon tetrachionde in the presence of antimony pentachloride by **Swarts reaction**.

$$3CCl_a + 2SbF_b \xrightarrow{SbCl_S} 2SbCl_s + 9CCl_2F$$
.

Alternatively it may be prepared by the action of hydrogen fluoride on carbon tetrachloride in the presence of carbon and ferric chloride. $CC^{\dagger}_{1} + 2HF \qquad CC^{\dagger}_{2} \rightarrow 2HCI + CC^{\dagger}_{2}F$

1 666

Freeze are used as refr germ; son refrigerators and air conditioners and hence is the name freeze.

These have also been used extensively as properlants for aerosois and foaths it spray but deciderants, cleansers, shaving creams, hair sprays and insecticides.

However freeza are persistent because micro organisms and other agents that cause biodegradation of natural organic materials are analized break these stable molecules or can do so only extremely slowly. Therefore, most freeze eventually makes as way into the atmosphere where in diffuses unchanged into the stratosphere. In stratosphere, freeza undergo photochemical decomposition and unitals radical chain reactions and depicts the protective ozone layer aminuming our earth. Therefore, are use of freeza as properties and refregerants has been dissociatly discouraged. It has also been banned in many countries.

6 DDT 2, 2-lus p-chlorophonyl *1,1 I Trichloroethane or p, p. Dichlorodiphonyl (richlorocchane

DDT was first prenared to 1873 but it was not onto 1899 when Paul Mulier at Gergy procuraceuticals in Switzer, and ascovered the effectiveness of DDT as an insection in Paul Mulier was awarded Noble Prize in Medicine and Physiology in 1948 for this discovery.

It is synthesised by reating a mixture of chioral α more with chlorober zero. 2 more in the presence of concentrated $H_nSO_{q^n}$

DDT is almost ascrible a water but it is moderate, soluble in point solvents DDT as a powerful narchindr. It is widely used as an insecticide for kiding mosquitoes and other insects.

ANALYSIS AND DIFFERENCES BETWEEN HALOALKANYS AND HALOARENES

The main difference between halosikanes and halosrenes is '

Haloalkane	Haloarene
The bringen atom in beloeikenes is very reactive and call be easily rentored by undeaphäve such as OH (N) - 30 N (as)	The langeur on whiterenes astrongly held a the nucleus and therefore, it cannot be easily repreced by numeropouss.

The annualkanes and haloarenes can be dissinguited by the following tests

1 Silver mitrate test. In this test, the halide is warmed with aqueous or strabolic K ≠H. The solution is then acidified with dil HNO₃ and AgNO₃ solution is added.

If precipitate occurs, it indicates alkyl, heavyl or aityl handes

If precipitate does not occur, it indicates and or vinyl habites

It may be noted that the precipitate former should be sociable in oil. HNO,

2. Assurgne's test. This test is performs to identify the nongenistom present at the compound. In this test, Lessingne's solution is prepared by beaung the compound with sodium metal. The Lessingne solution is boiled with all. HNO₃ are expelled the gases of evolved. Then and AgNO₃ solution to the residing solution.

White ppt soluble in NH_4OH indicates the presence of **chloride**—ight yellow ppt partially soluble in NH_4CH indicates **bromide**. Dark we low ppt in another in NH_4OH indicates todate.



- In each of the following pairs of compounds, which will give todeform test?
 - Ser-lintyl alcohol and hav butyl alcohol.
- Ethyl alcohol and isopropyl alcohol.
- Formaldetryde and ereusidetryde
- d. Methylpropy, ketone and diethyl ketone
- How will you distinguish between ethyl chloride and viny! chloride?
- 28. Name are product obtained when chloroform reacts we is a taking soil to all ver powder in stations to the presence of absolute KOH of sections.
- 30. Complete the following reactions

(a)
$$CCl_a + H_gC$$

$$rl$$
) $CH_3CH_4OH + I_0 + NnOH$

(c) CHCl₃ + O₂ Sumager >
 Write the IUPAC names if learners of 1.H₃ 1. Give not cast or distinguish these.

Answers to Practice Problems

- 27. π sec-incly) which π which alcohol m accomplehyde σ mothylpropy) ketone
- 28. Ethyl chloride reacts with encolaide AgNC, accution to give white ppt of AgCI whereas vinyl chloride does not react.

- 29. .a) Chloropicrin b) Acetylene c) Phenyl isocyrmide .d) Chloretone
- 81. I 2-Dichloroethane. I 1 Dichloroethane Hydrotysis of 1 2-Dichloroethane with aqueous Nat H gives ethylene glycol while the hydrotysis of 1 1-Dichloroethane gives ethanal.

SOLVED EXAMPLES

☐ Example 22.

- (a) How would you convert the following
 - (a) Prop-1-ene to 1-fluoropropane
 - in Chiombenzene to 2-chiorotoluene
- b. Write the main products when
 - (i) n-butyl chloride is treated with alcoholic KOH.
 - (ii 2, 4, 6-trinstrochiorobenzene is subjected to hydrolysis
 - (a.) methyl chloride is treated with AgCN.

(A.I.S.B 2015.

Solution

Churobeagene

z-Chiorotzanene

: 4 0-trustrophenol

■ Example 23.

a. Drow the strue, area of autjoir monohato products in each of the following reactions.

(i)
$$CH_{g}OH \xrightarrow{PO_{g}}$$
(ii) $CH_{g}-CH = CH_{g} + HRr$

b Which hatogen compound in each of the following pairs will react faster in S_n2 reactions.

A.I.S.B 2014

Selution (

ro, @ CH,I

(ii) CH,CF

☐ Example 24....

Write the product or products for each of the following reactions:

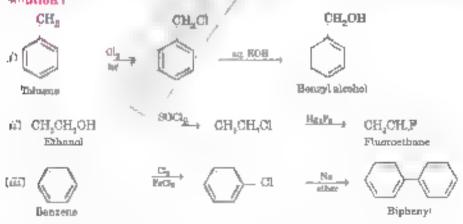
$$e = \begin{pmatrix} CH_{g}CH_{g}CH_{g}CH + CH_{g}COO & + & & & & & & & & \\ CH_{g}CH_{g}Br & + & & & & & & \\ & & & & + & & & & \\ CH_{g}CH_{g}CI & + & & & & & \\ & & & & & & \\ CH_{g}CH_{g}CI & + & & & & \\ & & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & & \\ & & & \\$$

So. atron

Example 25....

How was you carry out the following conversions in not more than two steps

Tomene to benevi accohor that to ethyr Amoride (in Benevie to biphenyl to I Chlorobutane to moctate Benevi alcohol to phenylethanen true in But I ene to But I ene to But I ene



Example 26.

Arrange the following in increasing order of him expected Syl reactivity

.
$$CH_sCH$$
 Br CH_s $CH_sCH_sEH_s$ Br CH_s $=$ $CHBr$ CH_s $=$ $CHCH$ Br CH_s

$$\begin{array}{ll} & \forall i\in H, \forall H=i\in H, \forall H_g\in H_g\in CH_g\in CI \\ & \forall i\in H, \forall i\in H,$$

Solution : CH = CHBr < CH, CH, Br < CH, CH, Br of H, < CH, = CHCH(Br = CH,

$$a = \mathsf{CH}(\mathsf{CCD} = \mathsf{CHCH}_{\mathsf{C}}\mathsf{CH}) + \mathsf{CHCH}_{\mathsf{C}}\mathsf{CH} + \mathsf{CHCH}_{\mathsf{C}}\mathsf{CH} + \mathsf{CHCH}_{\mathsf{C}}\mathsf{CHCH}_{\mathsf{C}} + \mathsf{CHCH}_{\mathsf{C}} + \mathsf{CHCH}_{\mathsf$$

Example 27—

The following compounds are given to you.

2 Bromopentone, 2-Bromo-2-methylbutane, 1 Bromopentune

to. Write the compound which is most reach is towards 8,2 reaction.

(b) Write the compound which is optically active

te. Write the compound which is most reactive towards β-euronation reaction.

(D S.B 20.7 A.LS B 2017

Solution 1.2 1-Bromopentane

2-Bromopentane

.c) 2-Hromo-2-methylbutane

■ Example 28.

Propose mechanism of the reaction taking place when

a + 2 Bromooctune reacts with section hydroxide to form ++-ortane-2 to

b 2-Bromoperatane is healed with rate A iH to form aikenes.

CBSE Sample Paper 2011



2-Dromopeutzue Peut Seue (Majur

Example 29₄

How will you convert the following tsopropyl chloride to a propyl chloride

att Chlorobenzene to benzoic acid

4. Propane to ally chiomde

out. Propene to propyne

Methy, bromide to ethylamine

(iv) Methyl brounde to acetic acid

tvi - I Bromopropane to 2 bromopropane

fully, Ethanol to but-1 yme

Example 80...

How we won distinguish between the forces my give one men not test

- Chlorobensene and ch-procyclobescale
 Chlorobensene and ch-procyclobescale
 Chlorobensene and ch-procyclobescale
 Chlorobensene and ch-procyclobescale
- re Etnyl chloride and viny, encerue d. Charotenzen, und a kerylchionde
- e Chlorovihore and bromoeth e P 3-Bromopropeus and 1-bromopropeus

Solution (a) Chlorobenzene and chlorocyclobezane Add a small quantity of squeous North to each compound Acidify with dil. HNO, and odd silver autrate solution.

Chlorocyclobenesse when sewed with eq. KOH undergoes sydrosysis to give potentian chloride. Potentian chloride reacts with silver nitrate in give white ppt, of AgCl

Chlorobeazene does not undergo hydrolysis under these conditions to produce phenol and KCI with aq. KOH. Therefore, it does not give while ppt.

(b) Chiorobenzene and benzyl chloride. Same as a · Benzyl chioride reacts with alcoholic AgNO, solution to give white ppt of AgCl while chlorobenzene does not give this test.

(c) Ethyl chloride (C,H,Cl) and vinyl chloride (CH₂=CHCl Ethyl chloride reacts with a coholic AgNC solution is give white ppt of AgCl while vinyl chloride does not give his wet.

This is because alkyl habides, C.H., I are more reactive, but vinyl unlines.

(d) Chiorobenzene and a heavichloride. Same as a "Reay! the ride is a translation and gives white ppt in this test in contrast chiorobenzene is anyl bande and does not give white ppt in this test.

(c) Chloroethane and bromoethane. Add a must immunit of aqueous K. H. c each compound Aridify with di. HNO and add a few drops of AgN — solution. A white ppt "Apt.1" insoluble in NH, the indicates chioroethane while light yellow ppt. AgBr) partially soluble in NH,OH indicates aromoethane.

(f) 5-Bromopropene (elly) bromide) and 1-bromopropene alkyl bromide. Add a small amount of dil alkaline KMnO₄ solution. Bueyer's reage: a each compound and shake 2-Bromopropene. "H. — CHCH, Br decisionness pank colour of KMnO₄, while 1-bromopropene (CH₂CH₂CH₂CH₃CH) does not



Conceptual Questions

Q.1 Out of CH,—CH—CH,—Ct and CH,—CH,—CH—Ch, which is more reactive towards $\theta_N 1$ CH, CH,

reaction and why?

(D.S.B. 2016)

Age. CH,-CH,-CH,-Cl is more reactive

CH,

The $S_{\rm s}1$ reaction proceeds through the formation of carbocation. The compound which forms more stable randocation will be more reactive

· Chiern-*-methylpropage

In Corbocaboo

OH, OH, 2-Chlorobatane 2° Carbonation

Since 3° corbocation to more stable than 1° murbicounts. 3-Chrombotane will be more reactive towards $S_{\pi^{\pm}}$ reaction.

Q.2. Which of the following two reactions is 5.2 and why?

A.I.S.B. 2010)

Ans. Reaction , as S_n2 because it proceeds by inversion of configuration

Q.3. Chloruform comtains objective but gives do resound with AgNO, solution. Why?

Ans. CHCi, contains chiorine but it is boulded in carbon by covalent bond and therefore, it is not in some form Hence, it does not combine with AgNO, solution.

CHCl, + AgNO, + No reaction.

Q.2. Out of HCl (g' and SOC), which is preferred for converting ethanol into chloroethane?

Ans. SOCL is preferred because in this case both the other products formed are gases. SO, and HC1 and escape reachly leaving behind pure chioroethene.

The second reaction is generally corried out in the presence of dehydrating agent such as anhydrate ZnCL,

Q.6. Why as chioroform stored in dark reloared bottles?

H.P.S.R. 2018.

Ans. Chloroform is exidused to personous phospens in the presence of our as

Therefore, a protect it from light chloroform is stored in dark coloured buttles.

Q.6. Balourenes are insoluble in water but are soluble in benzene. Explain.

Pb.S.E. 2016, R.P.S.E. 2016.

Helperance are incellable in state forestic these cannot form hydrogen bands with issue molecules. Hose-

Ann Halmannon are uncell'his in vistor horaine these cannot form hydrogen hands with inster molecules. However, were mose are soluble in senzene in secondance with the general principle of solubidity i.e. the dissolves tike. Halmannos are organic compounds having a large hydrocarbon part, benzene ring) and are soluble in hydrocarbon solvents like benzene.

Q.7. The p-momer of dichlorobenzene has higher melting point than o and m-isomer. Why?

Ans. The melting point of para conner is quite eigher than that of ortho or metal ermers. This is due to the fact that is has eymmetrical structure and therefore, its molecules can easily park closely in cryeta, include a receivable material forces of attraction are stronger and therefore, greater energy is required to areas, to lattice and it melts as higher temperature.

Q.S. lodoform gives a precipitate with silver nitrate on heating while chloroform does not

Ans. Carbon-adding bond is quite weak (2.3.4 kJ mol ³ as compared to carbon-abloring bond 325.4 kJ mol ³. Therefore, when todoform is heated with AgNO₃ solution. — 1 bond gets risaved easily and codedo one react will AgNO₃ solution to give precipitate of AgI. On the other hand, C.—Cl houd does not get cleaved.

Q.b. A small amount of ethyl alcohol is usually added to chloroform bottles. Why ?

Ans. Acohol retards be outdation of chloroform to phosgene and a converts phosgene any formed to harmless ethyl carbonate

2C,H,OH + COCL + (C,H,,CO, + 2 HC)

Q..0. Organic halogen compounds used in industry as solvents are chlorides rather than bromides and fodides. Explain.

Ans. Transmilkyl chromdes are used to industry as solvent because chlorides are more volable than immudes and todides.

Q.11 Predict whether the following substitutions are likely to be S, for S,2

Ans. (i) $S_a 1$ (because benzylic and secondary) (ii) $S_a 2$ (primary)

Q.12. Which effect will the resonance have on the dipule moment of vinyl obloride? CH_=CH=CI \cdots CH_-CH=CI

Ans. It will moreouse its dipole moment

Q.18. Why is vinyl chloride less reactive than ethyl chloride?

Ans. In vary, chloride, the electron pair on chiarms a announg agetes with the π electron pair of the double bond. $CH_* \rightarrow CI_* \rightarrow CH_* \rightarrow CI_* \rightarrow CI$

As a result, there is partial double once there is $C \cdot Cl$ and its good strength corresponding consequently it becomes difficult to cleave $C \cdot Cl$ book as compared to the good at ethyl chlande where an auch our against is possible.

Q 14. The use of chloroform as annes heta: is decreasing. Why?

(H.ESB 2016)

Ans. Because it: some cases. CHCi. couses corbec and respiratory problems. Therefore, as use as ansesthetic is decreasing

Q.15. A hydrocarbon C_3H_{12} gives only one chlorination product. Identify the compound.

Ans. The hydrocarbon which gives mor achieve derivative only is neopentane because in . As the hydrogen atoms are equivalent

Q.16. Give the IUPAC name of the product formed when

(i) 2.Methyl I becomopropage is treated with sodium in the prosence of dry other.

(a) 1 Methylcyclohexene is treated with HI.

Him Chloroethane is treated with eilver nitrite.

"RSE Sample Paper 2017 18:

2-Methyl-1-bromopropane

2, 5-Dimethylhexans

Meubylevelohesene

. lodo-l methytoyolohezana

Q.17 Product the order of reactivity of the following compounds in Sal reactions

Ans. is secondary holds and other three are tertary nalides. Therefore — will be least reactive. Comparing a > a and a we know that reactivity increases as chloride a immide a would be the compounds can be arranged in increasing order of reactivity as a = a(i) < a(

Q.18. Which of the following two compounds would renot faster by S_nZ path way: 1-bromobutane or 2-bromobutane and why?

CBSE Sample Paper 2007)

Ans. 1-bromobutane will react faster than 2-bromobutane by $S_{\mu}2$ path because the branchon state.

Q.19. Allyl chroride is more reactive than a-propyl chloride towards nucleophilic substitution reaction.

Explain why?

(CBSE Sample Paper 2007)

Ans. Ally chloride is more reactive than propyl chloride towards muckuph in smoothinition reaction. This is because of greater stabilization of anytic carbonation intermediate formed by resonance.

Q.20. Write the various possible isomers of C.H.Cl containing benzene ring. Which of these has weakest C—Cl bond.

Ans. Four isomers are possible. There are

p-Chimmtoluene

Out of these benzyl chionde (TV) has the weakest C-Cl bond.

Q21. An elkyl halide with molecular formula ("H_Br is optically active. What is its structure? (Pb.S.B. 2006)

Ann CH,-CHCH,CH,

Q.22. Which out of the two 2-evelopentonol or 2-syclopentenol has chiral centre.

Ans.



2-Cyclopentend has a chical centre

Q.23. Which of the two CH₁CH=CHCh₂Br

or CH_CHCH-CH_ is achiral and obtain.

Вr

Ans. CH, TH—CH [H,Br is actural because it does not contain chiral carbon storic $(H_1 \cap H_2)_{k=0}$] is chiral decrease it contains there exists atom.

Q.24. Aliyi chloride is hydrolysed more readily than a propyl chloride.

Ans. Allyl chiomde reachly undergoes ionization to form resonance stabilised carboration. Since carborations are reactive species allyl estion reachly combines with OH tons to form allyl sloobol.

$$\begin{array}{c} \mathrm{CH_{2} = CHCH_{2}CI} & \xrightarrow{\mathrm{torization}} \mathrm{CH_{2} \leftarrow Til^{2}CH_{0} + Cil^{2}} \\ \mathrm{Allyf chlorade} & & \downarrow \\ \mathrm{CH_{2} \leftarrow CH_{2} \leftarrow H_{2} \leftarrow GH_{1} + Cil^{2}} \\ \mathrm{CH_{2} \leftarrow CH_{2} \leftarrow H_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{Allyf alcohol} & & \downarrow \\ \mathrm{Allyf alcohol} & & \downarrow \\ \mathrm{Allyf alcohol} & & \downarrow \\ \mathrm{CH_{2} \leftarrow CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} } \\ \mathrm{CH_{2} \leftarrow GH_{2} \leftarrow GH_{2} \\ \mathrm{CH_{2} \leftarrow GH_{2} } \\ \mathrm{CH_{2} \leftarrow$$

However, no propyl chloride does not undergo ion-zation to form a propyl carbocasion and hence it gets hydrolysed less readily then allyl chloride

Q.25. What are enantiomers? Draw the structures of the possible enantiomers of 3-methylpent-1-enc. (D.S.B. 2006)

Ans. Stereosomers which are not supermonosible murror amages of each other are called conniumners. The countilmners of 3-methylpent-1-ans are

Q.26. Which will have a higher bosting point 1 chloroethane or 2-methyl-2-chlorobutane?

Give reasons.

/ IC.R.S.E. Sample Paper 2007.

Ans. "Methyl-2-chorobutane has higher noting point than 1-chlorobutane because with increase in size of alkyl group, boiling point increases."

Q37 Write the structure of major monoholo product of the following reaction:

Q.28. Account for following:

(a. Use of DDT was banned in United States in 1973.

b) Benzylic halides show high reactivity towards S_g1 reaction. CBSE Sample Paper 2011.

Ans. α Because of chemical stability of DPT and me for stability it is not metabolized very repolly by animals. Nother—gets deposited and stored in α to tissues. This reased alarming danger due to its large effects. Therefore its use has been banned in J.S.A.

b Benzylir bolides show high reactivity towards S_{g} , reactions because benzy carbonation formed is highly stable chrough resonance.

Q.20. Indoform has antiseptic properties. Give one reason to support this.

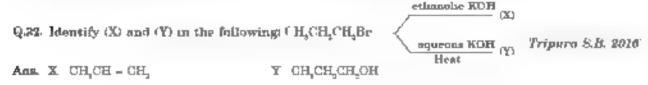
Ans. Indoform has antiseptic properties due to free aberared sodine.

Q30. A primary alkyl habde A), C B_pBr reacted with hot alreader KOH to give compound (B). Compound (B) reacted with HBr to give C s, which is an isomer of A) When (A) was reacted with sodium metal if gave a compound (D), C_pH_p which was different than the compound when a butyl brow de was reacted with sodium. Dive the structural formula of (A) and write equations for all the reactions.

Ans, (A. is iso-butylbrounds. The reactions are

Q.51. Optically active 2-indobutane on treatement with Nul in acetone gives a product which does not show optical activity. Explain.

Ans. The reaction of optionally active 2-iodobutane with NeI in acctone follows $S_{\mu^{+}}$ mechanism and leads to the formation of equal amounts of the two enanthomers. Thus is recenus machine is obtained which does not show options activity



IIII

Key Terms & Name Reactions

- Ambident audeophides. The nucleophides which have more than one site through which she reaction can occur.
- Optical sotivity. The property of a substance to rotate the piane of potanized light
- Charas. The objects which are one-superimposable on their nurrar images
- Chirality, The property of non-superimposability on da mirror image.
- Achtral. The objects which are superimposable on their mirror images.
- Chara, or asymmetric corbon. The carbon which is boaded to four different atoms or croups of stome
- Enantromers, optical isomers which are non-superimpossible mirror makes of each other
- Disstersomers. Stereoscomers which are not mirror images of each other
- Raceonic mixture. An equipmoar mosture of enantiomete. declro and one informa-
- Recommentation. The process of converting door of forms of an optionally serve compound data recentle form off.
- Resolution. The process of expansions a recently maximize and do or oforms executionness.
- Meso-compounds. The compounds which do not show option, set out. in spine of the presence of chiral stom.
 - Finkalstein reaction: RX + NaI Areine RI + NaX (X = Cl n* Rr)
 - Swarts reaction: ○H,Br + AgF → ○H,F + AgBr

Hunsdiecker reaction. Sover saits of carboxylio acuts are decomposed by Br., or I.

Birnbaum-Simonini reaction. Icdine forms enters with silver salts.

- ► Gattermann reaction. (A = 7 B)
- Raschig process.

$$2C_{\nu}H_{\nu} + 2HCl + O_{\nu} \xrightarrow{D=O_{2},A} 2C_{\nu}H_{\nu}Cl + 2H_{\nu}O$$

- ▶ Mendius reaction, CH,CN No C,H,OH, OH,CH,NH,
- ▶ Wurtz Fittig reaction. $C_sH_sCI + 2Na + ClCH_s \longrightarrow C_sH_sOH_s$ (Toluene)
- ▶ Fittig reaction: $C_bH_bCl + 2Na + ClC_bH_b \rightarrow C_bH_bC_bH_b$ Dipheayl)
- Ullmann reaction. C,H,I + 2Cu + IC,H, → C,H,O,H, ,Diphanyl.



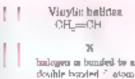
QUECK CHAPTER ROUND UP

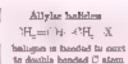
HALOALKANES AND HALOARENES





bestæne (Latero

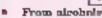


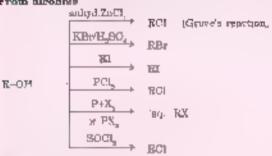




halogen is tompled to adechain C atom of benzere ring;

Preparation of Halostkones





From alkened

Finkelstein reaction

Acrione + CH_UH_I + NaBr OH OH Be + NoI

Nearts reaction

 $CH_{*}Er + AgF$ → DH,F + AgBr

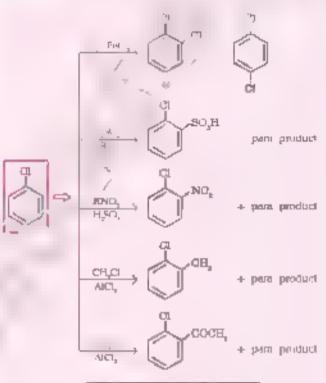
Borodine Hunsdiecker reaction

From benzene

From diagonom sato

· Hunstlecker reaction

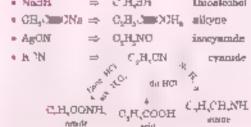
 \rightarrow %C_H_CI + 2H_O 10 H, + 2HO + CL



Reactions of halostkanes

Alkyl belides have polar G-X bonds and undergo au-deoplolic BUDGETELFOOR TRACKLOUR

The reacting common andeophiles with C,H,Br are.



Reactions with metals

Reduction

The reaction between primary alkyl habide. CH₂ Br) and hydroxide con OH² is second order reaction.

$$RX + OH \rightarrow ROH + X$$

 $Rete = k RXI IOH II$

In this resetion, the nucleoptide OH attacks the partially positively charged carbon atom of C. X bond from the direction

.80° eway from the balogen atom. This process occurs in one step. The reactivity of sikyl halides towards $8_{\rm s}2$ mechanism is methyl > 1° > 3° > 3°.

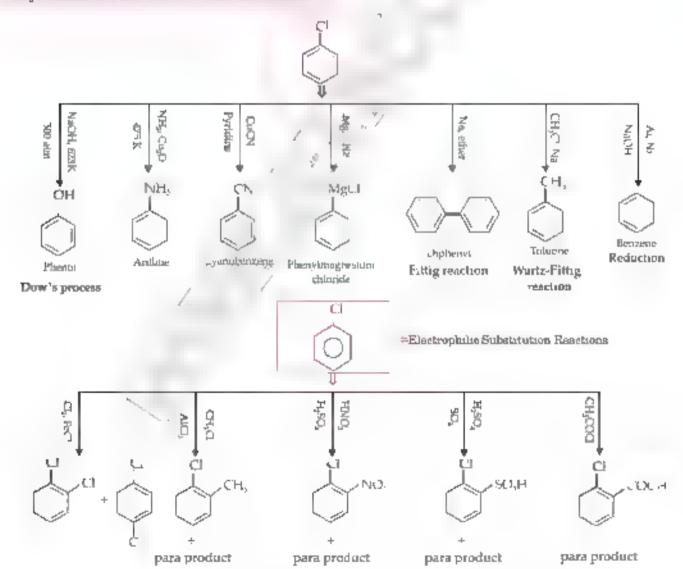
The $E_{n}2$ reaction is accompanied by inversion of configuration. The reaction between tertiary alkyl halids ((CH_n)_n CBr) and hydroxide ion to form xer(-busy) around follows first order kinetics: Rate = $k[(CH_{n})_{n}CBr]$ or in general, Rate = k[RX]

The S_g1 mechanism occurs through the formation of carbocation. The order of reactivity is: $3^\circ > 2^\circ > 1^* > methyl$

In case of optically active alkyl bandes, the product formed is a receme mixture.

Reactions of Haloarenes

Aryl halides are less reactive than halos, kanes









In-text Questions

Br



Q.1. Write the structures of the following compounds t

- (i) 2-Chloro-8-methy/pentane
- (iii) 1-Chloro-4-ethylevolohexane
- irl) 4-ferf-Butyl-0-todoheptane
- (r) 1-4-Dibromobut-2-ene
- (v) 1 Bromo-4-sec-butyl-2-methylbenzene

Ann. Refer Solved Example 3 Page 11.

Q.3. Why is sulphuric acid not used during the reaction of alcohols with kl ?

Ans. Sulphure and is an exidering agent. It will exidese H) produced during the reaction to I, and therefore with prevent the reaction between an alcohol and HI to form alkyl incide

Therefore, a non-exidence acid such as H₂PO, is used instead of H₂SO,

Q.3. Write structures of different dibalogen derivatives of propane.

Ans. Four sumeric ditailoged derivatives of propone are formed. For example

Similarly we may write four dibalogen derivatives of other balogens.

Q.4. Among the isomeric alkanes of molecular formula C_pH_{qp} , identify the one that an aboreomeal oblorination yields

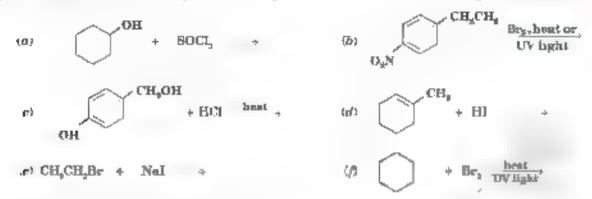
- (ii) A single mennebloride
- (iii) Three isometro monochlorides
- iri) Four isomerio monochiorides.

CH

Replacement of a ib or o History give different products

HALOALKANES AND HALOARENES

Q.5. Draw the structure of major monohalo products in each of the following reactions



Ans. Refer Solved Example 7 (Page 23)

Q.5. Arrange each set of compounds in order of increasing boiling points

- (a) Bromomethane, Bromoform, Chloromethane, Dibromomethane
- b) 1-Chloropropane, Isopropyl chloride, 1-Chlorobutane
- Ans. or For the same alky group boiling point increases with the increase of fire of the along a normal fire of the control of

Chioromethane < Bromomethane < Dibromomethane < Bromoform

b For the same assign, sowing point increases with increase or size of the alkyl group due to increase in van der Wasis forces of advection. Therefore boung point of a charmon one is more than that of lackloropropage. Further, he had nig point accreases as areaching increases so that the sound point of a charmopropage is angled than that of isopropyl chloride. Thus, the boiling point increases as

Isopropyi chloride « 1-chloropropana « , chlorobutane

Q.7. Which alkyl builds from the following pairs would you expect to react more rapidly by an S₆2 mechanism? Explain your onewer.

Ans. — CH Ch, CH, CH, Br reacts factor than $\mathrm{CH_2CH_2CHCH_3}$ This is because CH, CH, CH, CH, Br is a 1° alkyl halids while Br

CH,CH, [16], tale if alkyl bande. Since there will be some steric handrance in 3° alkyl halide than in 1° alkyl

halide, it will reset slowly.

- TH, CH, TICH, and react faster than CH, C—Bridge a lesser stem bandrance in 2' alkyl halide as compared to Bridge hands
- THE HILLS BY AND CHAPTER (III CHafter) are 1° alkytholides But at 11 the CH group a of C stars CHa

which is closer to Br arom while in Γ the CH₁ group is at Γ , arom, which is away from Br atom. Therefore, alkylikable Π has greater stone hindrance than Γ This Γ CH₂CH₂CH₂Br reacts faster than Γ CH₂CH₃CH₂Br.

CH.



Q.8. In the following pures of halogen compounds, which compound undergoes faster $S_{n}1$ reaction?

Ans. The reactivity of alky habde towards $S_N 1$ reaction depends upon the stability of the invermediate conformation formed as $3^{\circ} > 2^{\circ} > 1^{\circ}$

Q.9. Identify A, B, C, D, E, R and R in the following :

Since D gets attached to same C-atom as which MgBr or Br was present so that

R Br =
$$CH_3CHCH$$
, or R = $CH_3 - CH - 2H_3$ and C = CH_3 CH₃
 CH_3

Test-alkyl helides donot undergo Wurtz reschon. Therefore, the question is not correct. They undergo dehydrohelogenation to give alkanes. Hence, Ri-(CH_a,CH



Textbook Exercises



Q4 Name the following halides according to 11.PAC system and classify them as alkyl, allyl, benzyl (primary, secondary, tertiony), vinyl or anyl halides:

- от тен, "сненствен,
- во сңеңесендеңі
- (e) CH_CH(CH_)CH(Be)CH_
- (e.f) CH,C CI)(C,H,)CH,CH,
- ix) CH_iCH=(HC(Be)(CH_{in}
- (vi) m-C(CH₁C₄H₄CH₄C(CH₄)₄

$$\begin{array}{c} \text{CH}_3 \\ \text{CH}_3 \\$$

- (in) (CH, , CCH, CH Br)C, H,
- (oi) CH₁C(C₁H₁)₁CH₁Be
- (with) CH,CH=C(Cl)CH,CH(CH_{eff}
 - (a) p-CiC_aH_aCH_aCH_cCH_cCH_{cl},
- tsiii) n-Be-C,H,CH(CH,)CH,CH,
- 2-Chloro-3-methylbutane '2"-alkyl holider
- 9-Chioro-4-methylhexane (2) elkyl helides
- 1-Iodo-2, 2-dimethylbutone: 1° alkyl halide
- .-Bromo-3 %-dimethyl 1-pheaylbutone 2 benzylic hande
- Bronn-3-methylancene 3°-mkyl helide
- 1 Bromo-2-subyl-2-merbylbutane 10-niky balide
- 8-Chioro-3-methylpentane 5 alkyl habde
- 8-Chioro-5-methylhex-2-ene vinylio hande
- 4-Bromo-4-methy/pent-2-ene allytic finade

1-Chloro-4-(2-mathylpropyl) benzena (aryl halide)

CH, CICH, 20

1-Chiarmethyl-3x2 2-dimethylpropyl became 11-henzylic balide.

CHCH,CH, CH_2

. Bromo-2 . methytpropy! benzene ary! halide

Q.2. Give the ILPAC names of the following compounds

от съсъсываесь,

OO CHE,CB-CLE

in) CICH, (=CCH, Br

- in CCL), CCL
- (r) CH₁C(p-ClC₁H₁,CH(Br)CH₁
- (e^j) (CH_e),OCH=OIC,H_eI_e ρ

2-Bernic-3-claurobutane

a Mile Golde

. Brome . chlore 1 2,2-trifueroethane

on ClCH, C = C CH, Br

. Bramo-i-chlorobut-2-yme

2-(Trichlaromethyl+1,z : 2,3,3,3-heptachloropropane

2-Braun-3.8-bus, a-chlorophenyl)butane

CIC.H. 's

I-Chilara-Lass-indophenyls-9, 9-chmethylbul-1-ene

Q.3. Write the structure of the following organic balogen compounds

- (i) 2-Chloro-à-methylpentane
- (iii) p-Brosnichlorobenzene
- in) 1-Chloro-4-ethyloyolohexane
- (e) 2-(2-Chlocophenyl)-1-todooctane

(v) Perfluorobeazene

- of) 4-terf-Butyl-8-rodoheptane
- (91) 1 Bromo 4 sec butyl-2-methylhenzene (circ) 1,4-Dibromobut-2-ene

HALOALKANES AND HALOARENES

Ans.

2-Chloro-fl-methylpenome

ċн,ё́нё́нё́н₂ён, ст сы,

. p-Bromochlorobenzene

(a) 1-Chloro-d-ethyleyclohexene

24%-Clubropheny > 1-rodoctane

(e) Ferfinnesbessens

to 4-fort-Butyl-3-sodoheptase

(ptr) I-Bromo-4-ser-butyl-2-methyl benzens

(mii) 1, 4-Dibromobut-2-ana

(a) CH_zCl_z

(b) CHCL

Ane. (a)



 CC_1 is symmetrical and has resident zero dipole moment. In $CHCl_3$ b, the resident of two C. All dipoles is appoint by resultant of Σ -H and C-1 bonds. Since the latter resultant is experted to be smaller than the former. CC_2 has a definite dipole moment. It has been found to have dipole moment of 1.03D. In CH_1CL_{10} , the resultant of two C-Cl bonds is residured by the resultant of two C-Cl dipoles and therefore, it has a higher dipole moment than CC_2 . It has been found to have dipole moment of 1.82D.

Thus, CH.Cl, has the highest dipole moment.

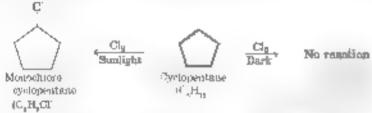


Q.5. A hydrocarbon C_iH_{in} does not react with chlorine in dark but gives a single monochloro compound C_iH_iC1 in bright sunlight. Identify the hydrocurbon.

Ans. The molecular formals suggests that it can either be a cyclonikane or alkene.

Since the hydrocarbon does not reart with (1), o the dark, it remark be an alkene. Therefore, it must be a cyclonikane.

The hydrocarbon reacts with Cl, in the presence of bright analight to give a single monochioro compound C_cH_cCl, therefore, all the ten. H-stoms of the cycloalkane must be equivalent.



Q.8. Write the isomers of the compound having formula C.H.Br.

Ane. The compound is saturated C.H., Br. It has following four isomers

Q.7. Write the equations for the preparation of 1-indobutane from

Q.8. What are ambident nucleophiles ? Explain with an example.

Ans. The nucleophnes which can attack through two different actes are called ambident nucleophiles. For example, cyanide is an ambident nucleophile because a can attack damagh, or N because of he following resonance attack damagh.

Q.9. Which compound in each of the following pairs will reset faster in 5,2 resetson with OH ?

D.S.B. 2008)

Ans. a CH, reacte faster than 44 Hr in 5,2 reaction with CH because I son is a bottor seaving group than Bri ion.

b CH₃CL is more reactive. here CH $_{2}$ CCI because of steric bindrance in case of CH₂ $_{2}$ CCI.

Q.10. Predict all the alkenes that would be formed by dehydrohalogenotion of the following halides with sodium ethoxide in ethoxol and identify the major alkene

(a) 1-Bromo-1-methyloyolokexane

.b) 2-Chloro-2-methylbutane

(c. 2,2,3 Telmethyl-0-bromopentane

Ans. α In a brome-1-methys velotiescene. β-bydrogens on either side of the Br atom are equivalent and hence only one alkene is formed.

b In 2-chaoro-2-methylbutane, there are two different sets of equivalent β-hydrogens and therefore, it can give two alkanes. I and II But according to Saytzeff rule, more highly substituted alkene II being more stable is the major product.

HALOALKANES AND HALOARENES

Bromoethene

c. 3 Brome-2.2.3-tramethylpenions has two different 8-hydrogen atoms and hence gives two different alkenes I and II But according to Saytzeff rule, more highly substituted alkene. If being more stable to the major product

Adrene II so more substituted than alkana I and hope, is more stable according to Soyteell rule Q.12. How will you bring the following conversions?

(a) Ethenal to but-1-yee (b) Ethane to bromoethene c) Propens to 1-astropropase (d) Toluene to benzyl alcohol. (e) Propene to propyne A Ethanol to athyl fluorida (g) Bromomethnue to proponone (b) Day-Lone to but 3-one (J) 1-Chlorobutane to n-octane J) Beazene to hiphenyl CH, CH, CIArts. (1) 4LCB.OR Eahanoi Liquit SH₀ HC=CH + NaNH, HC=C·No .H.2 Softman mestyleder CH_CH_CI + HC=C-Na* CH,CH,C =CH + NnCl But- 1 you



Q.19. Explain why

a) the dipole moment of chlorobenzene as lower than that of cycloheayi chloride.

(D. S.B. 8028)

b) nlkyl halides, though polar, are immiscible with water.

o) Grignard reagents should be prepared under anhydrous conditions? (CBSE Sample Paper 2011 Ans. a In chlorobenzens, the C of C. Cl bond is spr-hybridised while the C of C. Cl bond in cyclobexyl chloride is apt-hybridised.



Therefore, the sp-hybridized—of chierobenzane has more s-character and hence more electronagative than the sp-hybrid indirection of eyelohexyl chieff in As a result, the sp-hybrid of C—CI hand to chieff has less tendency to release electrons to A then the sp-third carbon of cyclohexyl chloride. As a result, the A-A-bond in chlorobenzane is less poten than in cyclohexyl chloride.

In other words, the large lide of negative charge one is less on Cl atom of chlorobenzens, has in cyclohexyl chlorids. Further due to delocation of lone pair of electrons of the Cl atom over the benzens ring due to resonance. — Cl and its chlorobenzens acquires some double bond character. On the other hand, C. Cl and its cyclohexyl character is our smalle bond.

Sure dipole moment is a product of charge and distance, herefore chlorobenzene has lower dipole moment than cyclobenyl chloride due to lower magnitude of charge 3- on Cl atom and amail 7—Cl distance

b Askyl balides are polar molecules and therefore, their molecules are beld together by dipole-dipole forces. On the other hand, the molecules of H₀O are held together by hydrogen bonds. When alkyl balides are added to water the new forces of attraction between water and alkyl bands molecules are weaker than the forces of attraction diready existing.



between alkyl hande-nikyl nande motecules and water-water motecules. Hence, alkyl nalidez are ummusible, not sofubte in water

 Ingram reagents are very reactive. They react with the moieture present in the apparatus or the starting materials RX or Mg

Therefore, Gegestal reagents must be prepared an anhydrous conditions

Q.18. Give the uses of

Freez 42, DDT, carbon letrachlocide and indeform.

Axis. Refer Text Book for uses of freen 12 Page 74 LDT Page 74-76 Carbon terrark oracle Page 74), indiaform (Page 74).

Q.14. Write the structure of the major organic product in each of the following reactions

Q.15. Explain the following reaction :

$$n \cdot \text{BuBe} + \text{KCN} \xrightarrow{\text{EtOH} \cdot \text{HyO}} n \cdot \text{BuCN}$$

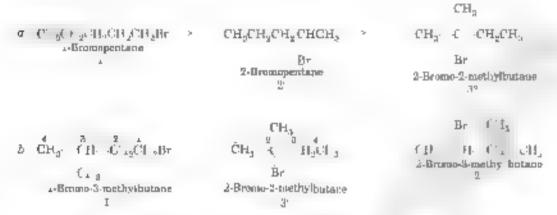
Ans. RCN has nucleophile CN too which is amindent nucleophile because of the following two contributing structures.

Therefore α can attack the carbon atom of C_1 . By bond α α -BuBr either through C or N. Since $C \rightarrow C$ bond is stronger than $C \rightarrow N$ bond, therefore the attack occurs through C to form α -butyl symmetric as

Q.16. Arrange the compounds of each set in order of reactivity towards S_e2 displacement

- (a) 2 Promo-2-methylbutone, 1 Bromopentane, 2 Bromopentane
- 45) 1 Brome-5 methylbutane, 3-Brome-2-methylbutane, 3-Brome-2-methylbutane
- (c) 1-Bromolutane, 1-Bromo-k, 2-dimethylpropane, 1-Bromo-2-methylbutane, 1-Bromo-8-methylbutane

Ans. The reactivity in S_{p} reaction depends upon stems handrance. Lesson ha stems handrance more has reactivity. Therefore, the reactivity of different alkyl halides towards S_{p} 2 reactions as $1^{\circ} > 2^{\circ} > 3^{\circ}$



So, the order of reactivity to

4 Bromo-3-methylbulane > 2 Bromo-3-methylbutane > 3 Bromo-3-methylbutane

CH₂ CH₃ CH₃ Br

CH₂

Brane-3-methyl butons

' with one branebung at y position

Thus, reactivity decreases with steric hindrance as

1 Bromouncene > .. Bromo-d-methylancene > .. Bromo-2-methylantene > .. Bromo-2,2-dimethylpropene

Q.17. Out of CaHaCHaCL and CaHai HeaCaHa which is more envity hydrolysed by aqueous KOH?

Ans. $C_{c}H_{c}CH_{c}Cl$ is a 1-aralley baside and $C_{a}H_{c}CHClC_{c}H_{c}$ is a 2° aralley baside. In S_{m} reaction, the reaction proceeds shrough the formation of exchanging in the first step, the aralley batide sources to give exchanging

The corbocation II is note stable than (I) because the +ve charge on carbon can be delocated over two benzene maps for the other hand, the +ve charge or carbocation I is delocated over only one benzene ring. Therefore $^*_{\alpha}H_{c}$ $^*_{\alpha}H_{c}$ $^*_{\alpha}H_{c}$ can be take easily hydrolysed when $C_{c}H_{c}$ $^*_{\alpha}H_{c}C_{c}$ in S_{ac} reactions. However in S_{ac} reactions, the reactivity depends upon be storic bundrance. Pharafore $^*_{c}H_{c}$ $^*_{c}H_{c}$ $^*_{c}C_{c}$ and $^*_{c}C_{c}$ and $^*_{c}C_{c}$ $^*_{c}C_{c}$

Q.18. p-Dichlorobenzene has higher m.p. and solubility than those of o-and m isomers. Discuss.

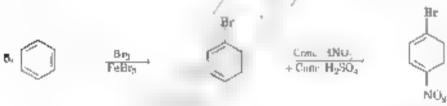
Ans. The methog point of personer of dichers benzene is higher than that of a and mesomers. This is because, personer has symmetrical structure and therefore, its molecules can enough pack closely or crystal lattice. Hence in his stronger intermo-couler forces of attraction than a and mesomer. Therefore, greater energy is required to break the intermolecular forces to melt in dissolve the mesomer, has the corresponding a and mesomers. In other words, his melting point of personer is higher and its solubility is lower than the corresponding a and mesomers.

HALOALKANES AND HALOARENES

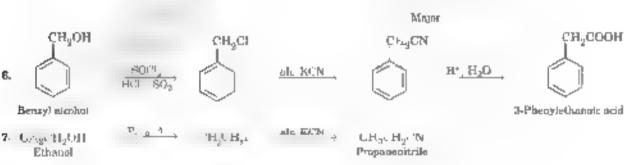
Q.19. How the following conversions can be carried out *

- 1 Propose to propos 1-ol
- 3. 1 Bromopropane to 2-bromopropane
- 5. Beazene to 4-bromonstrobeazene
- 7. Ethanol to propanentelle
- 9. 9-Chlorobutane to 3,4-dimethylbexane
- 13 Ethyl chloride to propanoic acid
- 13. 9-Chloropropane to 1-propanol
- 15, Chlorobenzene to p-nitrophenol
- 17 Chloroethane to buttons
- 19. /er/-Butyl bromide to isobutylbromide

- 3. Ethanol to but-2-yne
- 4. Toluene to benevi alcohol.
- 6. Benzyl alcohol to 2-phenylethanoic acid
- 8. Antime to object benzene
- 10. 2-Methyl-1 propens to 2-chloro-2-methylpropone
- 15. But-1-ene to a-butyliodide
- 14. Isopropylalechel to todoform
- 16. 2-Bromopropane to 1-bromopropase
- 18. Benzene to diphenyl
- 20. Antime to phenylancyonide



4-Brnmo ostrobenzane



Phettyllsocyantide

- Q.20. The treatment of alkyl chlorides with aqueous KOH leads to the formation of alcohols but in presence of alcoholic KOH, alkenes are major products. Explain.
- Ans. In equence KOH KOH is elimost completely initized to give. Home. These being strong nucleophiles result into substitution reaction on asky) chronides to form alcohole. Moreover, in equeous solution, the OH tons are aughly hydrated, solvated. The hydrotion reduces the basic character of OH; some which therefore, fails to obstract a hydrogen from the β-carbon of the alkyl chloride to form an allower.

On he other hand, an alcoholic solution of Ki H contains alternate Riv lone which being stronger base than DH one preferentially climmases a molecule of HCI from an alkyl valide to form alkenes.

- Q2. Primary alkyl balide (a) C₄H_pBr resided with alcoholic KOH to give compound (b). Compound (b) is resided with HBr to give (c) which is an isomer of (a). When (a) was reacted with sodium metal it gave a compound (d) C₄H₁₀ that was different than the compound when a butyl bromide was reacted with sodium. Give the structural formula of (a) and write the equations for all the reactions.
- Ans. Two premary alkyl balides having the motecular formula C,H,Br are possible. These are given below

When compound a was reacted with No metal of gave a compound of K. H_b, which was different from the compound obtained when a busy bromide was reacted with No metal and being the compound to must be asolutyl bromide and compound (d) must be 2,5-dimethylberane.

If compound a) is soluted incomine their compound b obtained on breatment with air NOH must be 2-merby! prop-I-ene

CH CH CH Br
$$\stackrel{\text{No. KOI}}{\longrightarrow}$$
 CH, $C = \text{CH}_2$

CH, $C = \text{CH}_3$

(a. Φ 2-Methylprop-1-ene

Lompound to on treatment with HBr gives compound in an aerordance with Markovinkov's ride

(c is an isomer of compound a.

Thus a) = (sobuty) brounds b' = 2-Methylprop-1-ene

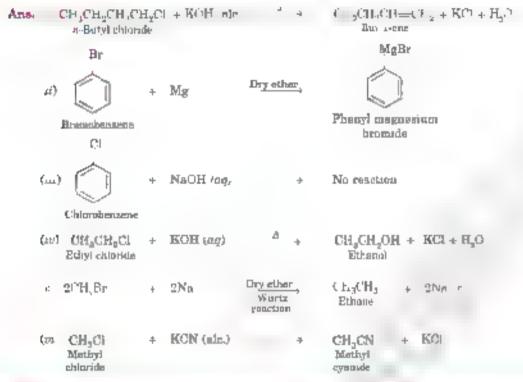
 $c = torr \cdot Butyl tromade (d) = 2.5 \cdot Dimethylherane$

Q.22. What bappens when

- i) a-butyl chloride is treated with alcoholic KOH,
- (ii) bromobenzene is treated with Mg in the presence of dry other.
- .irl) objectobenzene is subjected to hydrolysis.
- (iv) othyl chloride is treated with (ag' KOH,

-16/192-

- (v) methyl bromide is treated with sodium in the presence of dry ether,
- vi) methyl chloride is treated with KCN 7





Exemplar Problems



Objective Quartions from Exemptor Problems are given. en Campetetum File, page 144

- Short Reswor Tues Cues

Q. 1. Aryl chlorides and bromides can be easily prepared by electrophilic substitution of arenes with chlorine and bromine respectively in the presence of Lewis acid catalysts. But why does preparation of aryl indicine requires presence of an oxidizing agent?

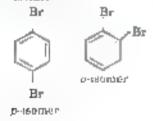
Ans. lodination reactions are reversible in nature. Therefore, to carry out the reaction in the forward direction, HI formed during rodination is removed by oxidation with iodic acid (HIO, or rutric acid (HNO,).

$$C_{i}H_{i}^{+}+I_{i} \Longrightarrow C_{i}H_{i}I_{i}^{+}+HI$$

 $5HI_{i}+HIJ_{i} \to 3I_{i}+5H_{i}O$
 $2HI_{i}+2HNO_{i} \to I_{i}+2H_{i}O+2NO_{i}$

Q.1. Out of c-and p-dibramobenzene which one has higher melting point and why?

Ans. p-Dibromobenzene has higher melting point than its materializes

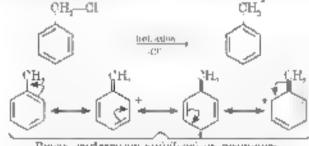


Subjective Questions

It is due to symmetry of p-isomer which fits in crystal inthice better khan the o-momen

Q.3. Which of the compounds will react faster in S., reaction with the OH ion?

S_. resetton proceeds through the formation of carbocausa intermediate ("HifH I readily indergoes iomzation to give CaHaCH, carbocation which is stabilized by reconnics.



Велгу сыгроскийн колийсгей ау гекиндин-On the other hand, CH,CH,Cl does not undergo ionization to give CH,CH,* carbocation. Therefore, C.H.CH.Cl reacts faster than CH.CH.Cl with OH ion.

Q.4. Why has codoform appreciable antiaeptio property?

Ans. Due to liberation of free toding when it comes in contact with skin

Q.5. Haloarenes are less reactive than haloalkanes and haloalkenes. Explain.

Ans. Hancerone are much test reactive than beloefined and bemelkenes towards undeceptable substitution reschange because of the following reasons

Resonance effect. In halomenes there is delocalisation
of electrons due to reconance. For example, chlorobenzene
is omerdered to be a resonance hybrid of the following
structures.

It is evident that the contribution of structures III, IV and V imports a partial double bond character to the carbon-chlorine bond. This is confirmed by X-ray analysis which shows that the C—Cl bond length in chlorobenzens is 1.69 Å while the C—Cl bond length in ethyl chloride molecule is 1.82 Å. The shortening of bond length imports stability to anyl balides and the bond cleavage becomes rather difficult. The anyl balides are, therefore, less reactive than alkyl balides.

In naivalkenes also, the filled p-orintal of halogen atom cannot overlap adewise with the unhybridised p-orintal of C atom. Therefore, C—C! bond is not very strong and can be essally cleaved.

2. Different hybridiantion states of carbon atom. In balacikanes the carbon atom of the C—X boul is splinybridised while in haloarene handes, the carbon atom is splinybridised carbon atom with a greater s-character is more electronegative. It can hold the electron pair of the bond more tightly than the splinybridised carbon atom in alkyl halides. Therefore, it has sees tendency to release electrons to the belogen. As a result, the bond cleavage in anyl halides is some what more difficult than in alkyl halides.

C arvolves spi Trybratisac in

Thus beloweres are less reactive towards the substitution reactions than below(knows

Q.6. Discuss the role of Lewis soids in the preparation of anyl bromides and oblorides in the dark.

Ann. Lewis actifs fielp to generate electropidis during the broutnesson and chiernasson.

$$Cl_{s} + PeCl_{s} \rightarrow PeCl_{s} + Cl^{*}$$

This remains non
Electrophiles

 $Br_{s} + PeBr_{s} \rightarrow PeBr_{s} + Br^{*}$

three soulure one (25 extraphiles)

The electrophile then attacks the bearane ring to form a carbocation which loses a proton to form anyl chloride to anyl brunide Q.7. Which of the following compounds (a) and b) will not react with a mixture of NaBr and H,SO, ? Explain why?

Ans. (b) A maxture of NaBr and H₂SO₄ gives Br₂ gas 2NaBr + 6H₂SO₄ → 2NaBSO₄ + SO₂ + Br₃ + 2H₂O Phenal (b) reseats with Br₂ to form 2, 4, 6-bribermorphene).

Phenol 'b) 2,4,6-tribromophenol

But CH, CH, CH, OH a) does not reast with Bc, water

Q.S. Which of the products will be unjor product in the reaution given below? Explain. (H,CH=CH, + HI -> CH,CH,CH,I + CH,CHICH,

Ans. (B will be the major product according to Markovnikov's rule.

Q.D. Why is the solubility of haloalkanes in water very low ?

Ans. The beloakanes are only alightly soluble in water in order to dissolve a halosikane in water energy is required to overcome the attractions between the halosikane morecules and break the hydrogen bonds between water molecules. Since less energy is released in the formation of new attractions between herosikane and water molecules and these ere not very strong as the ariginal hydrogen bonds present in water and hence the solubility of halosikanes is low.

Q.10. Draw other resonance structures related to the following structure and find out whether the functional group present in the molecule is ortho, para directing or meta directing.

p-Chimmlaluese

It is clear from resonating structures that there is increase in electron density at arthu and pare positions. Therefore the functional group X is ortho and paradirecting.

- Q.11. Classify the following compounds as primary, secondary and tertinry halides.
 - 1 Promobul-2-era (ii) 4 Promopent-2-ena (iii) 3-Bromo-2-methylympana
- Ans, (a Primary (a) secondary (as) tertiary
- Q. A. Compound 'A' with molecular formula C_iH_iHe is treated with aq. KOH solution. The rate of this reaction depends upon the concentration of the compound 'A' only. When another optically active isomer 'B' of this compound was treated with aq. KOH solution, the rate of reaction was found to be dependent on concentration of compound and KOH both.
 - Write down the structural formula of both compounds 'A' and 'B'
 - /rr Out of these two compounds, which one will be converted to the product with inverted configuration.
- Ans. (i) The molecular formulae of isomers of C_H_Br are

proponecA

Since the rate of reaction of compound 'A $(C_aH_aBr_a)$ with equeous KOH depends upon the concentration of compound A' only therefore, the reaction occurs by $S_{\rm pl}$ mechanism and compound A is tertiary branide to 3-bruino-2-methylpropene

$$CH_{a,b}CBe + KOH(eq) \rightarrow (CH_a)_bCOH + KBe$$

rate = $h(CH_a)_bCBe$

Since compound B' is optically active and in an isomer of compound A' (C,H,Br), therefore, compound B' must be 2-bromobutane Since the rate of reaction of compound B' with squeous KOH depends upon the concentration of compound B' and KOH, therefore, the reaction occurs by S,2 mechanism and product of hydrolysis will have coverted configuration.

$$rate = k \begin{bmatrix} CH_1CH_2CHCH_2 \\ Br \end{bmatrix} | K \cap H$$

Compared B will be converted with reverted configuration.

- Q. 18. Write the structures and names of the compounds formed when compound 'A' with molecular formula, C, H, is treated with Cl, in the presence of FeCl,.
- Ans. The compound with molecular formula C.H. is toluene, C.H.OH. Since -CH. group is o-p-directing, therefore, chloriostion of toluene gives o-chloriotuluene and p-chloriotuluene, in which the p-isomer predominates

Q.14, Identify the products A and B formed in the following reaction

$$\begin{aligned} \mathbf{CH_1}\cdot\mathbf{CH_2}-\mathbf{CH} &= \mathbf{CH}\cdot\mathbf{CH_1} + \mathbf{HOl} &\to \mathbf{A} + \mathbf{H} \\ \mathbf{Ann}\cdot\mathbf{CH_2}-\mathbf{CH_2}-\mathbf{CH} &= \mathbf{CH}-\mathbf{CH_1} + \mathbf{HOl} &\to \\ \mathbf{CH_2}\mathbf{CH_2}\mathbf{CH_2}\mathbf{CH_2} + \mathbf{CH_2}\mathbf{CH_2}\mathbf{CH_2}\mathbf{CH_2}\mathbf{CH_2} \\ \end{aligned}$$

Q 15. Which of the following compounds will have the highest melting point and why?

Arts. Compound II will have highest melting prant. It is because of the symmetry of poor positions that it fits into crystal tattice better than other isomers.

Q.15. Write down the structure and RPAC name for nea-penty/heamyle.

$$CH_3$$

Ans.
$$CH_0 = C + CH_2Br = 1$$
 Bromo-2 - 9-dimethylpropane
$$CH_3$$

Q.17. A hydrocarbon of molecular mass 72 g mol⁻¹ gives a single monochloro derivative and two dichloro derivatives on photo chlorination. Give the structure of the hydrocarbon.

Ans. The hydrocarbon having molecular mass 72 g mol⁻¹ is C_aH_c (pentane). The isomer of pentane which gives single monochloro derivative should have all the 12 hydrogen equivalent of is

Monochioro derivative CH₈—C—CH₉Cl

Q.18. Name the alkene which will yield 1-chloro-1methylcycloherane by its reaction with HCL Write the reactions involved. Ann. Two nikenes are possible. These are methylene cyclohexane and a-methyleyclohex-1-ene

Methylenecyclohexane

$$CH_a \xrightarrow{RCh} CH_a$$

1-Methylcyrlohez-1-eoe

- Q..9. Which of the following halosikanes reacts with squeous KOH most easily? Explain giving reason.
 - o I-Bromobutana
 - ii 2-Bromobutane
 - on 2-Bromo-2-methylpropane
 - tic 2-Chlorobutane
- Ans. (iii) 2-Bronn-2-methylpropans (3") because tertiary carbonston formed during the reaction is most stable
- Q.20. Why can aryl halides not be prepared by reaction of phenol with HCl in the presence of ZnCl, 7
- Are. This is because C—O bond in phenol is more stable due to resonance effect and it has some double bond character. Therefore, it is difficult to broak this bond and bears aryl halides are not prepared by the reaction of phenol with Hill.
- Q.21. Which of the following compounds would undergo S_a1 reaction faster and why?

Ans. (B) Undergoes S_N reaction faster because the earbocation formed after the loss of Cl is stablized by resonance

On the other hand, the carbocation formed during the residues of (A), in put resonance stabilized

Q.22. Adyl chloride is hydrolysed more readily than a propyl chloride. Why?

Ans. Allyl chlorade shows high reactivity because the carbocation formed by hydrolysis is stabilised by resonance while no such stabilisation of carbocation exists in the case of a-propyl chlorade

- Q.23. Why is it necessary to avoid even traces of moisture during the use of a Grignard reagent?
- Ans. Griginard reagents are highly reactive and react with water to give corresponding hydrocarbons.

 RMsX + H₂O = + RH + Ms(OH)X
- Q.24. How do polar solvents help in the first step in B_1 mechanism ?
- Ans. The S_a1 mechanism proceeds through the formation of carbonation. It involves breaking of C—halogen bond for which energy is obtained through the solvation of bands ion with the proton of the protoc solvent. Thus polar solvents help in ionisations step by stabilizing the ionis by solvation.
- Q.25. Write a test to detect the presence of double bond to a molecule.
- Ans. The presence of a double bond in a molecule is tested by treating the compound with Br, water. The alkenes decolorises the brown colour of Br, water.

- Q.36. Diphenyls are potential threat to the environment. How are these produced from arythalides ?
- Ans. Diphenyls such as p, p -dichlorodiphenyl trichlomethane DDT's are posing serious environment problems because of its chemical stability and its fat solubility. Its residue accumulates in environment and its long term effects could be highly dangerous.

Diphenyls can be prepared from oryl helides by the following two methods:

Fittig reaction

Vilimenn burryl synthesis

Q.27 What are the IUPAC names of the insecticide DDT and benzenehexnehloride?

Why is their use banned in India and other countries?

Ans. D D T = 2 2-bis p-chlorophenyl) in 1-trichioroethane BHC = 1, 2, 3, 4, 5, 5-nexachlorocyclohexane. These have been beause of their long term tonic effects which could be highly dangerous

These are non-budgerdable. These insectiones enter the food chains of animals and get deposited in their fatty tissues over a period of time. Therefore, these affect their reproductive system

- Q.26. Elimination reactions (especially β-elimination) are an common as the nucleophilic substitution reaction in case of alkyl halides. Specify the reagents used in both cases.
- Ans. Alkyl halides undergo nucleophilir substitution as well as elimination (β-elimination) reaction

However by proper choice of reagents and reaction conditions, a particular product can be obtained. Usually strong and balkier bases and high temperature favour elamination reactions while weaker and smaller bases and lower temperature favour substitution reactions. For example, ethyl bromide on heating with alcoholic KOH which contain stronger base C_2H_4O not, at about 473-528 K undergoes elimination to give athene. But with aqueous KOH as about 570K, it gives athenel.

$$\begin{array}{ll} \text{CH}_{1}\text{CH}_{2}\text{Br} & \xrightarrow{\text{obs} \text{ B}} & \text{OH}_{1} = \text{CH}_{2} \text{ `Eltunnution'} \\ \\ \text{CH}_{1}\text{CH}_{2}\text{Br} & \xrightarrow{\text{obs} \text{ B}} & \text{CH}_{2}\text{CH}_{2}\text{OH} & \text{(Substitution)} \end{array}$$

Q.29. How will you obtain monohromobeneous from anihne 7

Ane.
$$\begin{array}{c|c} NH_{h} & N_{e} \text{ CF} \\ \hline \\ N_{e} \text{ N}_{e} \text{ CF} \\ \hline \\ N_{e} \text{ CF} \\ \hline$$

Q.30. Aryl balides are extremely less reactive towards nucleophilic substitution. Predict and explain the order of reactivity of the following compounds towards nucleophilic substitution:

Ans. Presence of electron-withdrawing groups (such as NO₂, at o- and p- positions with respect to independences the reactivity of balogens towards nucleoplane substitution renotions due to the stability of the intermediate carbamon. More the number of such groups at o- and p- positions with respect to halogen, higher is the reactivity. Thus, the order is III > II.

Q31, tert-Butylbromide reacts with eq. NaOH by S_c1 mechanism while n-butylbromide reacts by S_g2 mechanism. Why 7

Ans. In general, the S_p1 reaction proceeds through the formation of carbocation. The *text*-butyl bromids reachly loses Br. ion to form stable 3° carbocation.

Therefore, it rescut with aqueous KOH by S_{all} mechanism as

On the other band, n-butyl brounds does not undergo conzerved to form n-butyl carbocauch (1°) because it is not stable. Therefore, it prefers to undergo reaction by $S_{\rm p}2$ mechanism, which occurs in one step through a transition state involving nucleophilic attack of OH can from the pack side with simultaneous expulsion of Hr can from the front side

 $S_{\rm g}1$ mechanism follows the reactivity order as $6^{\circ} > 2^{\circ} > 1^{\circ}$ while $B_{\rm g}2$ mechanism follows the reactivity order as $1^{\circ} > 2^{\circ} > 5^{\circ}$

Therefore, text-butylbromide 3') reacts by S_{μ} 's mechanism while a-butylbromide 1') reacts by S_{μ} 2 mechanism

Q.32. Predict the major product formed when HCl is added to isobutylane. Explain the mechanism tovolved. E.

CH.

2-4 haomi-2-mathylomounton

The mechanism involved in this reaction is Step I

5" carbocation is more stable than 1" and is predominantly

$$CH^0$$
 CH^0 CH^0 CH^0 CH^0 CH^0

Q.38. Discuss the nature of C-X bond in the baloacenes.

Ann. In balancenes, the carbon atom of C-X band is sp^2 hybridised and therefore, is more electronegative than sp³ hybridized carbon atom in beloekkanes. Therefore. this an' hybridised carbon has iese lendency to release electrons to X stom of C-X coud in anyl halides and therefore. C-X bond is less polar in anyl halides as compared to alkyl halides

Q.34, How can you obtain indosthens from ethanol. when no other indine containing reagent except NaI is avadable in the laboratory?

Finkerstern reaction)

- Q.35. Cyonide ion acts as an ambident nucleophile. From which end it note as a stronger nucleophile in aqueous medium? Give reason for your PARMENT
- Ans. Cyande. :C = Nr. 100 is an amhidentate nucleophile and can react through C as well as N end. It acts as a stronger nucleophile from earbon end because it will read to the firmation of C—C bond which is more stable than. C—N bond forming alleyl oyanule.





MEMORY TEST



Say True or False

- L. The dipole moment of CH_F is larger than that of CH_CH
- 2. In general, alkyl halides are more reactive than anyl-മലവർക്ക
- CH_CH_I is more reactive than CH_CH_CI towards KCN.
- Carbon tetrarbionde is inflammable.
- CH,CH-CHCl is more reactive than CICHLOH-CH.
- 6. 2, 3, 4-trichlompantone has three oxymmetric earbon
- Chlorobenzene and beneyl chloride can be distinguished. by boiling with aqueous KOH followed by acidification with dil HNO, and subsequent treatment with AgNO,
- B. Addition of BrCCL, to propens in the presence of parameter gives 3-oromo-1. . . i-tmchitoro-a-methylpropane
- Iodide ion is a better nucleophile than bromide ion.
- Chlorobenzena gives a white precipitate with alcoholic sifver retrate solution.
- a. 3-Dimethylbut-1-ene reacts with HI to form 2-rodo-8. 3-dimethylbucane and 9-indo-2, 3-dimethylbutane
- 12. Bromoethane reacts with nilver mitrite to form sthyl mitnite.
- 1, 1 Dichioroethane resets with aqueous KOH to give ethanai

- .4. Throethers are obtained by rearting alkyl handes with end on hydrosulplade
- 15. Boiling point of indobengene is more than that of Introductions

Complete the missing links

- Isobutyl bromide as an example of alkyl halids.
- Nitro alkanes are formed when alkyl handes react with and alkyl mitrites are formed when alkyl balides renet wich
- 8. Hydrolysis of 2-brumo-3-methylhutans gives the auguer product
- 4 Toluene reacts with Cl, in the presence of FeCl, to give
- 5. D D T is prepared by condensing with chlorobenzane in the presence of
- Chlombenzene on reduction with NvAl alloy and alcohol 関係を発出
- Formation of phenol from chlorobeazene is an example. anomater aubotshubion.
- 8. Indobenzene on heating with copper powder forms diphenyl This reaction is called
- Butanenitrile can be prepared by dealing with. alcoholic KCN
- With potassium cyamides, alkyl halides give while with aliver eyemde, they give

- 1... Alkyl halides are insofuble in water because they donot form ... with water
- BHC is commercially called
- ng KOH , NHATHOOH 18. CH. CHC.
- 14. C_pH_qOl OuCN pyridine
- Chiprobensene + Sodoum + Methyl chiomis + 2Nnt 1
- CH₁I + C₂H_{3/2}NH
- Za/Co Chuple 17 СН,ОН,СИСН.
- 18. CH, CH, Br.
- AR S R + NaX
- 20. OH, OH, Br. + + CH, CH, C = CH + NaRe

Choose the correct alternative

- 1 Reaction of alky) halide with potessium sulphite gives throethereithusarcahais.
- Boiling point of text-butyl brounds is legalmore than that of a-butylbromide

- Aryl bromides can be prepared by reacting effect salt of exometic scide with Br, in OCI, This reaction is called Hunsdischer reaction Box-Schiemann reaction.
- Dipole moment of CH, F is less/more than that of CH, Cl.
- Dipole moment of a-dichiocobenzene is tyssimpy than that of m-dichlorobengene
- 6. $S_{*,1}/S_{*,2}$ proceeds through the formation of a carbocation
- 7 CHBrCIF has churalfactural carbon atom
- 8. S.2 reaction occurs with inversion of configurations nacentralization
- L or Class, the compound IIII undergoes feeter 8_1 reaction.
- 10. Induhenzane when heared with copper powder gives total energy by the right
- 11 O.H.Cl in less/more reactive than C.H., Cl.
- 12. Tetrachterenuthenaltruedemethane has been used as пправрые



MEMORY TEST

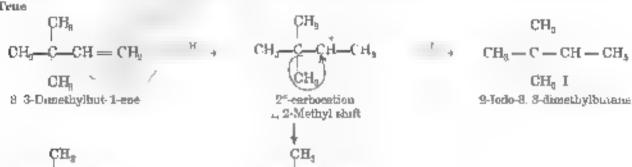


- 3. True
- 5. Fetue

- Folce: It has two chiral attens, CH, CHUHCHCH.
- 8. False: CH₁OH CH₂ BrOCK CH₂CH-CH₂CCl₂

2 Bromo-1 L, 1-trichlorobotane

- False. Due to resonance the Control and chlorobenzene has some double bond character. Therefore at does not muze to give C1 rons. Hence it does not give white precipitate with alcoholic AgNO,.
- 11 True



 CH_a $\overset{\circ}{C}$ CH CH_b $\overset{r}{\longleftarrow}$ CH_a $\overset{\circ}{C}$ CH CH_b

3°-carbocation

- 2-Indo-2, 3-dimethylbutane rearranged product
- Folse : It forms mitmethans.
- 13. True
- more stable 14. Palse
- 1ត. True

Complete the missing links

- 1. ormany
- 2. ailver minte, potassium minte
- Chloral, cone H.SO. 9. a -propyl brounde
- benzene
- alkyl ryanidas alkyl mocyanidas 11. bydrogen bonda.
- 2-Methylbutan-2-ol
- 7 nucleochilic
- 4. e- and e-discretofueue
- 8. Ullimanure reaction
- gennuarene

Nat? = "H

- 48. CH_CHO
- 14 CHEN CHECOE

- 17 CH, CH, CH, CH, CH, CH, CH, CH, CH, CONH,
- 19. No. 3R

15. taluene

e the operest alternative

- 1. thoethers
- 9. less
- Hunsdiecker reaction.

- d. Jesa
- 1888

- a. S.I
- 7. chierd
- 🕹 ചുഴഞ്ഞെ ന് വേനില്ലാര്ക്കാ
- ø. I
- 10. dipbeoy)

- 1. less
- 12. tripodomethane



Higher Order Thinking Sk

Advanced Leve

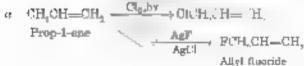
QUESTIONSWITTMANSWERS

L Why alkyi buildes are generally not prepared in the laboratory by free radical halogenation of alkanes?

Ana. Free radius, natogenation is not suitable method for ashorsony preparation of alkyl valides because of one filtow ing reasons. It Because of the presence of different types of hydrogen atoms present in alkanes they give a mixture of groupers manohalogenoted products whose boiling points are so close that they cannot be easily separated in the inboratory.

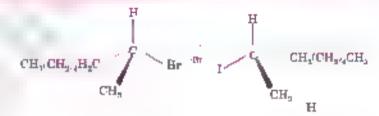
- (ii) Substitution of more than one hydrogen atom yields polybologen compounds making the maxture more complex and hence difficult to separate.
- Propose reaction for the preparation of (i) allyl iodide and (ii) ally! fluoride from prop-1-ane.

Ans. (r) Allyl todate to prepared from prop-1-see as



2. R: 2 Brammostane reason with hydrogen oulphide (HS+) for and gives (S+2-octanethial with inversion of configuration at the stereocentre. Can we plan to get (R.-2-octanethiol from N 2-bromocrtane?

Ans. R + 2-octanethiol can be obtained from R + 2-bromooctane by double inversion to get net retention of configuration. For example, an S₂2 reaction with 1 ion would give .8)-2-iodooctane. Then, it is reacted with HS: to give (R)-2-octanethio)



R 2-octanistical

4. BCI is hydrolysed to ROH slowly but the reaction is rapid if a cashlytic amount of KI is added to the reaction mixture. Explain.

Ana. lodide a a powerful nucleophile and herefore it reacts rapidly with RCl to form RI



Further I' um is a better leaving group than CI maand therefore. RI is more readily hydrolysed to form ROH

→ R—OH + I:

5. Ontically active (S+2-iodocctane with NaI in nretone gives a product which does not show optical ostivity. Explain.

Ana. In this S_a2 reaction, inclide acts as a nucleophile as well as the leaving group. Therefore, in this reaction, iedide displaces include. When 2-indoordance (I is readed with I ion. it undergoes stereochemical inversion to give 2-iodocctane (II which is enautomer of (I) Now (II) undergoes stereochemical. inversion to give (I). This reaction is fast and occurs multiple times, each time inverting the stereochemistry. Ultimately,

this results in a 50 - 50 raceono mixture) of two enanthomers (L and H. In other words optically active 2-induoclass indergoes recommended

6. An alkyl halide X, of formula $C_8H_{13}Cl$ on treatment with potassium tertiory butoxide gives the isomeric alkenes Y and Z (C_pH_{12}). Both alkenes on hydrogenation give Z, Z-denothylbutane. Predict the structures of X, Z-and Z-

Ans. It is given that

The two alkenes forming 2, 3-dimethyl butane are

7. A dibniogen derivative (A) of a hydrocurbon having two carbon atoms reacts with alcoholo potash and forms another hydrocarbon which gives a red precipitate with ammoniscal solution of cuprous chloride. Compound 'A gives an aldohyde when treated with aqueous KOH. Write down the name and formula of the compound.

Ans. The compound is a dihalogen derivative of a hydrocarbon containing two carbon atoms. It may be CH₂CHUl, or CH₂CICH₂Cl. The reaction corresponds to CH₂CHCl₂ and is ethylidens chaoride as

B. An organic compound C_sH_{ss} on monochlorination gives a single monochloride, Write the structure of the hydrocarbon.

Ans. Since the hydrocarbon gives a single monochloride all the 18H atoms are equivalent. This means it has six CH_{ν} groups attached to the interlinked C atoms

Therefore, its structure is

9. If relative rates of substitution of 1° and 2° H are in the ratio 1 8.8, show that in the presence of light at 298 E, the chlorination of a butane gives a matture of 72% 2-chicrobutane and 28% 1-chlorobutane.

Ans. According to the reaction

The relative rates of two moments chromobutanes will be equal to their number of types of H's 1° 2° or 8°; and their relative rates of substitution.

Now if x is the percentage of 1-chiorobutane, then Percentage of 2-chiorobutane = 100 - x

$$x = 0$$
 $x = 5.2$
 $10.2 x = 600$ $6x$
 $2x = 600$
 $x = 26\%$

1-chiorobutane = 28% and 2-chiorobutane = 72%

 The following reaction gives two products. Write the structures of the products.

$$C_{\alpha}H_{\alpha} = C + C_{\alpha}H_{\alpha} + C_{\alpha}H_{\alpha} + C_{\alpha}H_{\alpha}$$

$$C = C + C_{\alpha}H_{\alpha}$$

$$C_{\alpha}H_{\alpha} + C_{\alpha}H_{\alpha}$$

$$C_{\alpha}H_{\alpha} + C_{\alpha}H_{\alpha}$$

11. Which 6,1 reaction would you expect to take place more rapidly?

(d) (i) (CH_i)_iCCI(LOM)+CH_iCH_iO-(LOM).
$$C_{2}H_{1}OH$$
 \rightarrow (CH_i)_iCOCH_iCH_i + Ch

 $0.0 \text{ CH}_{13}\text{COCH}(1.0\text{M}) + \text{CH}_{1}\text{CH}_{1}\text{O+2.0\text{M}}) \xrightarrow{C_{2}\text{H}_{2}\text{OH}} \rightarrow \\ \text{CH}_{13}\text{COCH}_{1}\text{CH}_{1} + \text{CH}_{2}\text{COCH}_{2}\text{CH}_{3} + \text{CH}_{2}\text{COCH}_{2}\text{CH}_{3} + \text{CH}_{2}\text{COCH}_{3}\text{CH}_{4} + \text{CH}_{2}\text{COCH}_{4}\text{CH}_{4} + \text{CH}_{2}\text{COCH}_{4}\text{CH}_{4} + \text{CH}_{2}\text{COCH}_{4}\text{CH}_{4} + \text{CH}_{2}\text{COCH}_{4}\text{CH}_{4} + \text{CH}_{2}\text{COCH}_{4}\text{CH}_{4} + \text{CH}_{2}\text{CH}_{4} + \text{CH}_{2} + \text{CH}_{$

Axe. (a Reaction iii because Bir ion is a better leaving group then Cl. ion

- 5 Reaction because he reactions is a territory hands. Moreover pheny, halides are not reactive a Sq. mactions.
- ϵ . Reaction ϵ because water is more polar solvens, has methanol and S_{μ} reaction takes place faster in more polar solvent.
- d' Both reactions occur et die same rate because S_N1 reactions are undependent of the concentration of the nucleophile
- .2. Hydrolysis of 2-brosio-3-methylluitone '2' gives only 2-methyl-2-butanol '3'). Explain.

Ans. During $S_{g,*}$ constant the ionization gives 2° curbonium which rearranges by a hydride shift to a more stable S° -corbonation to form S° -stable as

.3. Baloalkanes undergo nucleophilic aubstitution reactions while halourenes undergo electrophilic aubstitution reactions. Explain.

Ans. Haronkenes are more polar than halosrenes. Therefore, the carbon aron carrying the halosen is more electron definient. It more positively charged than that in paperenes. As a result paperal and anterior authorities and transfer and than barosrenes.

On the other axid hatocretes contain a benzene ring. Since the typical reactions of senzene are electrophilic substitution reactions, therefore hatocretes indergr electrophilic substitution reactions preferably while hatoclkanes which donot contain a benzene ring donot undergo electrophilic substitution reactions.



Revision Exercises

Vors Short Ressur Coastions

Carrying mark

- 1. How we you able to 1 brown propens from propens ?

 (H.P. S.B. 201)
- Write the structure of 2-chloro-3-methylpentene

Assam S.P 2012

9. Out of $B_{g^{\pm}}$ and $B_{g^{2}}$ reactions which reaction gives the inversion of configuration? HP SE 2018



Complete the reartion

H P S R 9018

 Arrange the following alky has destructed of increasing reactivity towards the nucleophide substitution. S₂2r

Megharaya, 8.B. 2018)

6. Write the structural formula of 4-chloro-2-pentens.

- 7. Write the IUPAC name of CH₄Ci
 Hr S.B. 2016)
- Out of ρ-dichorobenzene and ρ-dichoro-benzene which has higher melting point and why?
- How does indebenzene react with copper powder? What is the name of the reaction?
- Complete the following reaction: CH,

- 11 A solution of ROH bydrolyses CH₂CHC CH₂CH and CH₂CH₂Th₂Th₂Cl Which one of these is more easily bydrolysed? If \$7.90 a.
- 12. How does chlombenzene react with sodium in the presence of other? What is the name of the reaction?

- 14 Which of the following a most reactive lower is $S_{\rm p} 2$ reaction? CH_Br CH_ $_{\rm c}$ CHBr CH_ $_{\rm c}$ CBr
- 15. What is Wurte reaction?

10. H,C Pr + AgF

Name the reaction.

- H₄C F + AgBr Kamataka 5 B 2014, 2018

Hr SB 2017

- 17 Write the IUPAC name of the following compound CH _CCH,Br D.S.B 2011*
- Write the sUPAC name of the following compound CH₂ = CCH₂Br

- 10. Write the RIPAC name of CH₂—OH—OH₂—CH—CH₂

 O S B 2015
- What happens when the Habr is treated with R. IN 7.
 D.S.B. 2010

CH₃

2: Write the ILPAC name of CH, CH = CH—C—CH.

--10/112-

22. Write the IUPAC name of (CH₂₄CHCH(Ct)CH₃

D.S B 2013

28. Which compound to the following pair undergoes faster $S_{a}1$

reaction 7 CI CI

L.S.B. 2013

24. Arrange the following balides in order of morensing $S_{\rm e}2$ reactivity

CH_{3/3}CCI, CH₄CI CH₄Br. CH₄CH.CI, CH₄hCHCI Methatave S.B. **2014**)

25. Which would undergo S_wS reaction fraterin the following pair and why?

CH₃
CH₄ CH₅ CH₅ CH₅ D.S.B 2015
An

26. Out of CH₂—CH—CH₂—C1 and CH₃ CH₂ CH Cl, which is CH₄ CH₄

more reactive towards $S_{w}1$ reaction and why? $(D.S.B.\ 2016)$

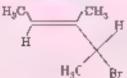
27 Arrange 2-bromo-2-methylbutana. 1-bromopentana and 2-bromopentana an order of increasing $S_{\rm p}2$ reactivity

Tripura S.B 2016

- What product is obtained when toluene is treated with Cl₂ in the presence of light: (Maghalayer 9 R 9018)
- Write the structure of 2. 4-dautrochlorobenzene JD.S.B. 20.7.
- 30. Write the structure of i-bromo-4-chlorobut-2-ene. [J.S.B. 1017]
- Write the structure of 3-promo-2-methylprop-1-ene (D.S.R.9917)

CBSE QUESTIONS 🚓

22. Give the IUPAC name of the following compound:



A.I S B 2010

23. Write the IUPAC name of the following

H CH,

A.I.S.B. 2013)

54. Write the IUPAC name of the following compound

CH₀ CH—CH₀ CH₀ CH

85. We a the RIPAC name of one following compound

CH₀-CH-CH₁-CH-CH₀

Br Cl (A.I.S.E 2013)

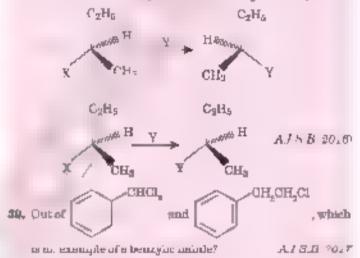
36. Write the Π PAC arms of following compound

A.J S.R 2010

37 Identify the chiral molecuse in the following pair

A. S.B W.

38. Which of the following two renctions is $S_{\nu}2$ and why?



40. but of _____ and ____ X which is an examine of vinylic ballde? A.I.S B 2017

41. Out of and X which is an example of allylic halids?

A.I.S.B. 2017

MCQs from State Bourds' Examinations

- 4th. C.H.Cl on beating with alcoholic KOH will produce
 - e O.H.OH
- (b) O,H,
- r) C.H.
- (d) C.H. Sharkhand S.B. 2013)
- 48. Alkyl balides are less and this in water because they have in). Low melting puts.
 - 6. Do not form H-bond with FLO
 - (c) Viscous in anhurs
 - d) Have very strong C-X bond.

(Hr S B. 2014)

- 44. Among the following which one is chlorine contriuming insections?
 - a DDT
- 6, Freun
- .c Phosgens
- d) Iodoform (Kerula S.B. 2018

HALOALKANES AND HALOARENES

- 45. The boding points of halcalkanes follow the order
 - (a) RI > RHr > RCI
 - biRCl > RBr > RI
 - te) RI > RCl > RBr
 - (al) RBr > Rt > RC1

Nagarand S.B. 2015

- 40. The charal compound at
 - (a) 3-chloropentane (b) Propens
 - (c) 2-chioropropane
- d) 2-chiorobutane

Hr S.R. 2015

- 47. Which of the following has anglest dipole moment in the following 7
 - (a) CH.F
- (b) CH,Ct
- (c) CO1,
- d) CH,I

Hr S.B. 2015)

- 48. Which of the following is not a polyherogen compound?
 - (a) Chiorularm
- (h) Preco
- (c) Carbon tetrachlonde (d) Chiorobenzene

Kerula S.B. 2016

- 49. The case of dehydrohologenation of alkyl halides with atcoholic KOH is:
 - (a) 3" < 2" < 1"
- (b) 3" > 2" > 1"
- (c) 3" < 2" > 1"
- .d) None of these.

Hr S.B 2017

- Alkyl bubbles are prepared from alcohol by treating with.
 - (a) HCl + ZnCl,
 - ф:H_SO, + КІ
 - (c) NaCl + H,SO,
 - al) None of these.

(II) E.B. 2017

- Organic empound which shows complete stereochemical. inversion during $S_{n}2$ reaction m.
 - (a) CH, Ct
 - ъксн, сн—с⊩
 - (e) (CHL),C-C1
 - (d) None of these.

, (Hr S B. 2017)

- Which of the following reaction is most autable for the preparation of a-propylbenzene?
 - (a) Frieder-Crafts aukylomon
 - b) Wurtz rescuon.
 - (c) Wurtz-Fitting reaction
 - al) Grignard reaction

Manupur S.B. 2017)

- 58. C,H,Cl + CH,Cl + 2Na Тыв гевенов в
 - (a) Stephen
- (b) Sandmeyer's
- (c) Fittig
- d) Wortz-Fitting
 - Hr S.B. 2018

+ 2NaCl

- 54. In the given riky) holides which one has minimum boiling nous!?
 - (a) C.H.F
- (b) C,H,I
- (e) C,H,Cl.
- (a) C,H,Br

(Hr S.E. R018)

- 65. S_2 reaction will be featest in.
 - (a) CH,Br
- (b) CH,Ci
- (c) CH,CH,Cl
- (d) (CH_c),CHCl Hr S.B. 2018.

56. For the compounds, "H, \,\ CH,I \, 'H,Br and

which of the following is the correct order of C-halogen. bond Jerasth⁵

W B S.B 2018)

Short Finamer Questions | corrying 2 or 3 marks



- How as ethy! bromide energeted into
 - (a) athanol /
- ,b) ethyl acetace
- (c) diethys runme ,d) proprince need?
- 2. How will you convert.
 - (a n-propyl bromide to mo-propyl bromide
 - a 1-bromopropane into propens
 - iii) il-propanni into i-bromopropane
 - 40 2-rhiorobutane into butanol?
- 2. How will you dusting ush between
 - Vinyl chioride and ethyl chloride Chlorobenzene and cyclobexyl chloride
 - ai) Ethyl chloride and ethyl bromide?
- 4. (a Relogrence undergo electrophilic substitution reaction. at ortho and para position. Explain.
 - (b) Complete the following reaction:

$$CH_*Br \xrightarrow{D_{Y}:D_{W}} A \xrightarrow{N_{B},C_{2}H_{2}OH} B$$

Mesorum S.B. 2015.

- Write the following reactions.
 - (i) Swarts reaction
 - (a) Saudmayer reaction
 - (iii Wurtz-Fitting reaction

(Rr S.B. 2018)

- 0, (a) How are the following conversions be carried out.
 - Benzene to diphenyl
 - (h. Andine to chlorobenzene
 - (b) Why is trichloromethane stored in flark coloured bottles? Give resson with related squation.

(Uttorakhand S.B. 2015)

7. Explain as to why helogrouss are much less reactive than Enhalkanes towards nucleophilic substitution reactions. TLE B 2008, A.I.S.B 2008 Hr. S.B 2018 2014 2016, 2018 H.P.S.B. 2017, 2018, Kerata S.B 2017, Nagatand S.B 2017)

Or

Which compound in each of the following pairs will react faster in 8_02 reaction with $-\Theta H ?$ Why?

- (I) CH,Ee
- DE: CHJ
- (a) CH₁₀COL or CH,Cl
- P.S.B. 2008

- Write the equations for the sleps in S_n1 mechanism of the conversion of tert-Butyl bromide into tert-Butyl alcohol.
 - a) Explain Fitting reaction.
 - .b) Name the reagent used in the debydrabalogenation of brimikanes. (Karnataka S.B. 2018)
- 2. .a State one use each of DDT and redeform
 - b) Which compound in the following couples will react faster in \$2 displacement and why?
 - (i) 1-Bromopontane or 2-bromopentane
 - Bromo-2-methylbutane or 2-bromo-2-methyl busine D.S.R 2010.
- 10. Explain why
 - (i) The dipole moment of chlorobensene is lower than that of cyclobexyl chloride
 - a) Griguard reagent should be prepared under unhydrous conditions.
 - ce Hainalkanes shough polar are manaschle with water? CHr S.B. 2011, H.P. S.B. 2018,
- 1. Answer the following

Halosikanes analy dissolve in organic solvenie, why?

- What is known as racenic nexture? Give an example.
- of the two bromodernatives C_eH_ePH CH_eBF and ²_eH_ePH ³_eH_eBr which one is more concluse in S_e1 substitution reaction and why? (D.S.H. 2011).
- 11. Asthough characters as electron withdrawing group, vet it is ortho-pare-directing an electrophilic articles substitution reactions. Explain why is it see (D.C.B. 2018)
- 18. Identify A and B

or H · H= 'H. Hur A aq. KORI - N

- (a) Explain why through chloride (SOCL) method is preferred for preparing alkyl—fondes from a cobols.
 - b) For someon baloatkanes it aboung point decreases with branching of chain. Why?

Maghalaya S.B. 2018)

15. Identify the major product at the odowing reactions

Assan S.B 2018

- 16. Write chemical reactions to prepare the followings
 - a DDT from chlorobenzene
 - b) Freon-12 from carbon tetrachionide.

· Ottorakhand Board 9014

 /c/ Which alkyl halide from the following pair is chiraland undergoes faster S_v2 reaction "

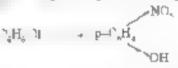
- Out of S_1 and S_2, which reaction occurs with
 - 42 Inversion of configuration
 - o Recemisation.

DSB 2014)

 Draw the structure of major monoholo product in each of the following reactions

DSB. 2014

- 19. a Wher is the condition to be astudied for a compound to be chiral?
 - b) Index what roud noise 2 methy propens one be converted once substyl arounder a bromo-2methy propose by hydrogen brounds? Write the correct reaches involved.
 - dow will you carry the following conversion?



(Maghalaya S.B. 2015).

- 20. Explain S_u: reaction mechanism of balcalkane Arrange the reactivity of 1° 2° and 3° balcalkane towards S_u2 reaction.

 Nagatand S.B. 2015
- Explain why baloarenes undergoes electrophics substitution reactions at ortho and para positions only
 Micron S B. 2018
 - b The p-isomer of dichloro benzene has aigher melting point than as ortho and meta-isomers. Explain.

Misoram S.B. 2018

22. ,a) Complete the resotion

CH,CH,Br + KOH are

- Explain why the nee of chilomform as an esthetic is decreasing
- .c) What happens when bromobenesse is treated with megnesium in the presence of dry ether? JLP S.B 2015.
- 28. How will you convert the following:
 - (a) Propens into asopropyl branide

Propene into a propyl acousede

IL S.B 201.

- 24. Explain the following reactions
 - a. Printing reaction
 - b B Elimination reaction

ςμ'n

Discuss $S_{n}1$ and $S_{n}2$ reactions with statelile examples.

Hr S.B. 2016

- (a) Alkyl habdes react with AgNO, and KNO, to give R—NO, and R—ONO respectively. Why?
 - b) Heinerenes are insoluble in water but are soluble in bensens. Why? Ph. S.B. 2015
- What happens when ethyl bromide rearts with
 a) AgNO.
 - 5 AgCN nle.)?
 - b) The p-isomer of dichlorobenzene has higher melting point then a and memoria. Why? Ph. S.B. 2015
- 27 (a) Haioalkanes react with potassium oyanide (KCN) to give alkyl cyanide but gives alkyl isocyanide with silver cyanide (AgCN)
 - (b) Why are balourenes more stable than baloukanes? HP 8.B 2016
- 28. Give ressuma.
 - (a) a-Butyl brounde has higher builing point than t-butyl brounde
 - b) Recease ourture is optically inactive
 - (c) The presence of natro group NO₂) at o/p positions increases the reactivity of haloarenes towards nucleophile substitution reactions. (D.S.R. 2015)

ČĮ ČH⁴C)

- 29. (a) In and dentify the compound which will undergo S_1 reaction faster and why?
 - to Explain the following
 - a contribute of a contribute of the contribute o

A caymmetric carbon

OH: S.B 2018

Explain B_n2 reastion mechanism of heloalkanes.

Nagorane 8 B. 10 B

- .e) In the following balagen compounds, which one will readily undergo B₂2 reaction:
 CH, CL CH, C C1
 - b) Complete the following reaction.

CH, Br + C,H, ONa + (Assum S.B. 2016.

- 82. a Aryl habdes are uses reactive in nucleophilic substruction reactions
 - (i) Write any two reacons for less reactivity
 - 42 Give one example for madeophilic substitution reactions of any) heades
 - b) Write a method for the preparation of alkyl handes
 - Which of the following is not a polyhalogen compound.
 - a Chioroform
- (a) Freon
- n Curbon cetrachloride
- (iv) Chlorobenzene Keraia S B. 2016.
- 83. (a) Gave two methods of preparation of hazoulkanes
 - Give two uses of redeform. James 8.B 2016.
- 34 (a) Write DDT structure. Give harmful effects of DDT
 - b) Write Wurtz-Fittig reaction. (H P.S.B. 2016)

- a. What are amindent nucleophiles? Explain with an example.
 - b) Write Bandmeyer reaction

HPSB 2016-

- 36. Стув геолода.
 - G—OI bond length in chlorobenzene is shorter than
 G—CI bond length in CH,—CI
 - ti) The dipole moment of chlorobenzene or lower than that of cyclobexyl chunde
 - m. S_p1 reactions are accompanied by recommended in optically active alky handes. L.S.B. 2016
- 87. c Arronge the following in their reactivity towards S_g2 reaction and give the reason for your answer Primary helids, secondary helids, tertiary halids and methyl halids
 - Write the chemical reaction involved in the conversion of propens to propyre. Microram S.B. 2017)
- 88. Identify A and B in the following two reactions:

Assam S.B. 2017:

- 89. Write the following reactions:
 - i) Wurtz reaction.
- (iii) Sandmeyer's reartion.
- Ullman reaction.

Pb S.B 20171

- 40. (1) Why are helosrenes more stable than hains kanes?
 - ii) Alkyl halides reset with AgNO, to give R-NO, or R-ONO Explain. (Pt S.B 2017)
- 41 a) What is DPT?
 - Complete the reaction.

42. .a) In the following pair of hangen compounds, which would undergo S_a1 reaction faster?

- Explain why Grignard reagents should be prepared under embydrous conditions
- (c) Starting from benzene, prepare diphenyl in not more than two steps. Meghataya S.B. 2017)
- 43. a. Complete the reaction
 - a) CH.CH.Br Agon ..

CH_CH_Br Dry either

b) During the 8-elemination reaction of 2-bromspectage in an absolute solution of KOH results pent-2-ene as impor product and pent-1-ene as amor product. State the rule to explain the reaction.

Kernla S.B. 2016:

-COSE QUESTIONS ---

- 44. How would you differentiate between S_p1 and S_p2 mechanisms of substitution reactions? Give one example of each.
 4. S.B. 2016, Hr S B 2018
- 40. fu. What is meant by chirality of a compound ? Give an example
 - b) Which one of the following compounds is more easily hydrolysed by KOH and why?

чи,оноки,он, от он,силон,сі

 c) Which one undergoes S₂3 substitution reaction faster and why ?

40. 'a. Draw the structures of major monahala products in each of the following reactions

(b) Which halogen compound in each of the following pours will react faster in S₂2 reaction

- 47. .c. How would you convert the following:
 - .∩ Prup-1-ene to 1-fluoroprupaue
 - a. Chlorebenzene to 2-chlorofotaene
 - (b) Write the main product when
 - a Bodyl chloride is treated with alcoholic KOH
 - ii) 2, 4, 6- trimtmehlombenzene is anbjected to hydrolysie
 - that methyl chloride as treated with AgCN

48. Write the major annuabalo product(s) in each of the following reactions:

49. Following compounds are given to your

2-Brancopentane 2-Branso-2-methylbutane ... Brancopentane

- Write the compound which is most reactive towards 8_2 resource.
- Write the compound which is optically active
- (ii) Write the compound which is most reactive towards β-traination reaction. D.S.B. 2017)
- 50. Out of chlorobenzene and benzyl chloride, which one gets easily hydrolysed by aqueous NnOH and why?

A 1 S B. 20,81

51. a Identify the chiral materile in the following pair



- b. Write the structure of the product when chlorobenzene is treated with methyl chloride in the presence of sodium metal and dry ether
- Write the structure of the sikens formed by denydrohelogenstion of 1-brome 1-methyloyelehexage with alcoholic K.-H.

A.I S.B 2018)

Long Resuer Questions - carrying 5 marks

- ta. For the preparation of alkyl chiorides from alcohola, through chioride (SOCL) is preferred. Give reason.
 - b) Hausetkanes undergo β-elimination reaction in the presence of accoholic potaesium hydroxide
 - 21 Which is the major product obtained by the β-elimination of 2-bromopeutasis?
 - Name the rule which leads to the product in the above elimination reaction.
- (a) Identify all possible alkenes that would be formed on debyteshningene bon of 2-chloropentage with accepture KOH. Also identify the major alkens.

b. Write the products of the following reaction which is a first-order reaction giving the steps involved

e) Draw the structures of major atonohalo products in each of the following reactions:

- 3. Explain the following reactions:
 - c) Balz Schiemann reaction
 - (iii) Wurdz reaction.
 - (...) Ullmann reaction.
 - api. Give two uses of chimoform.
 - v) The dipole moment of chlorobensene is lower than that of cycloheryl chloride Explain. (Pb. S.B. 9014)
- 4. Write short notes on the following
 - and Finkelstein reaction
 - b) Markovníková zuše
 - (c) Hunadiecker reaction

Or

- (a) An organic compound A having molecular firmula C_sH_s on treatment with di. H_sSO_s gives B B on treatment with cone. HCl and anhydrous ZuCl_s gives secondary helide C Write all the reactions and identify A. B and C
- (b) Convert ethyl chloride into methyl chloride

H P.S.B. 2014

- 6. Write short notes on the following
 - (a) Sandmeyer's reaction
 - the Friedel-Craft's alkylation
 - (c) Anti-Markovníkov's rule

Qr

- (a) A hydrocarbon 'A (C₄H₆, as added with HBr in accordance with Markovnikov's rule to give compound B' which on hydrolysis with aqueous alkali forms tartiary alcohol 'C' (C₄H₆O). Identify A, B and C.
- (b) Convert chierobenzene into phenol. H.P.S.B. 2014

- ,σ (i) Write the equations for the steps in S_p1 mechanism
 of the conversion of tert butyl bromids into tert
 butyl alcohol
 - (i) Hillogrenes are less reactive towards nucleophine aubstitution reactions than asionikanes. Give a reason
 - 5' Complete the following equations

(d) C_H_OH + SOCI_ --

Karnutaka Board 2014

- a' How will you differentiate between S_a1 and S_a2 reactions'
 - b Why does the treatment of alkyl chloride with aliver oftrate form introdikane and with potassium nitrite form alkyl mirite? (Ph. S.B. 2018)
- 8. a An amhadept mudeophile is:
 - Asumona
- (ii) Ammonium 100
- Clumde ma
- .m Mitarte un
- b Heiosikanes and halosreuss are organohalogen compounds.
- Suggest a method for the preparation of alkyl chieside.
- Aryl babries rue less reactive lowerds nucleophibe substatution reactions Gave reasons.

Kerma & B 9017

Hints & Answers

for Revision Exercises

Leev Short Answer Onestions

- I. CH₃CH=CH₃: HBr →CH₅CH₂CH₂Br
- сн₁—сн—снен₂сн₃
- 8. S_e2

N, CI





 $\mathbf{5},\quad (\mathrm{CH}_{1/2}\mathrm{CCI} < (\mathrm{CH}_{1/2}\mathrm{OHCI}_2 < \mathrm{CH}_1\mathrm{OI})$

CH,

6. CH,CH = CHCHCH,

- 7. 1-chioco-1 phenylmathane
- 8. p-dichlorobenzene The p-isomer is more symmetrical and therefore, fits better into its crystal other. As a result the intermolecular forces are larger than the corresponding or isomers. Hence p-isomer has higher meting point.
- 9. Diphenyl is formed. Reaction is called Ullmann reaction.

 GH_{0}

Cinc

CH.OE





H,0



Benzył alcohol

- CH₁CHCCH,CH₂
- 18. 1-chium-2-phenylethane.

- 12. Diphenyl is formed. The reaction is Fitting contains
- 14. CH,Br

16. Swarts reaction.

18. 8-Bruno-2-methylpropens

20. Ethanymitrile is formed.

CH.Br + KON

21. 4-Bromo-4-methylpent-2-ens.

25. 2-Chloro-3-methylbutone

2, 2-Diniethyl-1-bruniopropane

4-chloropeut-1-ene

 CH₂C = N + Kbr Kultationaltrue

24, $(CH_{i,j}C) < (CH_{i,j}CHC) < CH_iCH_iC1 < CH_iC1 < CH_iBr$

25. CH, CH, Br.

26. CH, CH, CH CL

27. 2-bromo-2-methylbutane « 2-bromopentane « z-bromopentane

SA. Benzyl oblaride

32. 4-Branio-8-methylpent-2-ena

34. 3-Chioro-2, 2-dunethythulane

43. (b)

48. al)

58. (al)

88. 8-Brown & methytoropene

2-Dromo-4-chloropenane.

36. . + Dichimotoluene

CHCL

48. (a)

50. (a) 55. (a) 46. d)

51. .E

42. .60

52. .03

47 (b

56. (a)

Additional Useful Information and Objective Questions

ADDITIONAL USEFUL INFORMATION

▶DISSYMMETRY CONDITION FOR ENANTIOMERISM

d4. (n)

49. (b)

54. (a)

Desymmetry is an essential condition for optical activity. In other words, the molecules which are not symmetric will form non-superimposable mirror image called enantiomera.

Thus, the essential criterion for chirality of a molecule in to form enantioniers non-superiorposable nurror mages as the dissymmetry cobsence of plane of symmetry. In other words, the fundamental condition for enontiomerium to dissymmetry

These enablemers are represented as d- or + and or ϵ + ϵ have be noted that the enablemers are like to now superimposability of marror images and this gives them the property of optical activity. Therefore, enantromers are also referred as optical isomers.

The exact oness have identical chemical properties, and therefore, they form same products. However, they differ to the reactivity towards other optically active substances. For example, + factic acid and lactic acid have summer chemical properties. When these engineers are treated with optically active ser-butyl acohor, both form esters but their rates of reaction are very different.

It may be noted that the fundamental condition for enantiomerism is dissymmetry. A unlecule wind: a dissymmetric will exhibit enantiomerism and the enantiomera have dissymmetry. Thus, dissymmetry is necessary and sufficient condition for enantiomerism.

However the presence of asymmetric carbon atom is important for evantioner and the not the easential and sufficient condition. There are certain molecules which contain more than one sermine indicarbon a sine but are optically mactive. For example, main form of tarture and.

Resultant and cartain and

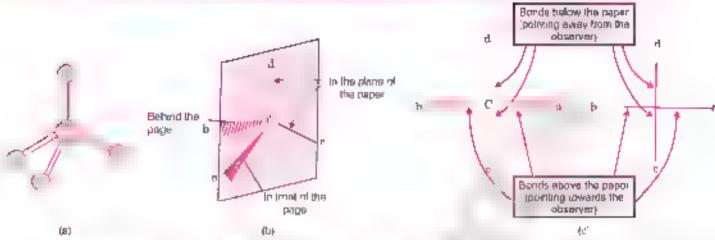
In this to decide, there is a consent symmetry so that we will if the distance is the instruction angle of the other half.

As a result at a optically inactive. An optically another more is a whose more use a superimposable on its nurver stage is quite of the presence of asymmetric carbon atoms is known as a meso compound. Such a notecule can be recognised by the fact that it possesses a mirror plane which divides the molecule and two balves which are mirror mage of each other. Therefore, is trially inactivity of a meso, imaginar to a disc to internal compensation. The two balves of the molecule ratate the plane of polarized light to apposite directions and hence cancel the effect of each other.

Similarly, there are molecules which do not contain all vasymmetric carbon atom but are enantiomers. For example, 2, 3-pents, some exists to two forms which are non-superintpose tie, across angles and are optically active.

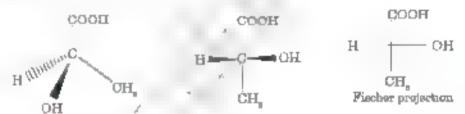
CONFIGURATIONS AND FISCHER PROJECTIONS

The arrangement of atoms that characterizes a particular stereotsomer is called its configuration. It is very difficult to draw three dimensional arrangement of atoms or the configuration of a mosecule on a paper two dimensional. Therefore, various graphic methods have been proposed. The anaplest method is the Weinge formula. In this representation, a tetrahedral molecule with four atoms or groups of the anal dibonded to a can be represented by a Wedge formula. A solid wedge or a nearly one represents a bond proporting above the plane of the paper of bonds pointing towards you and a dashed wedge or a dashed line represents a bond below the plane are bond pointing away from you. Sould onessor contain our linear represent bonds in the plane of the paper. These representations are shown ahead.



A snaphficular of Wedge form do a Fucher projection. In Facher projection a tetrahedral curbon atomic represented by two crossed ones. In this projection, the chiral carbon is at the centre of intersection of the missions, and vertical ones and by convention, it is not above in the Facher projection. The four groups attached to the chiral carbon are placed on the four ends of the cross. The horizontal lines represent bonds coming out of the plane of the paper directed towards the viewer) and the vertical lines represent bonds going back from the plane of the lapter away from the viewer. The carbon observable drawn vertically with C. 1 at top. For example, the molecule of about may be represented as shown before an Fig. c:

For example, Reactic acid can be drawn as



NOMENCLATURE OF SURREOISOMORS

There are two commonly used nomenclor are systems or convents as for stereosomers

1. D and L-system 2. R and S-system.

L D and L System of Numerodature

This is an older system of depositing absolute configuration of enanthomers. The main chain of the carbon containing the chiral return is arranged vertically on the page with the carbon in the higher oxidation state, the line with more C—O bon is on the sup The carbon, bonds extend behind the binne of the page and the nonzonta, bonds project in front of the plane of the page. When the molecule is arranged in this manner, his configurations are designated returned to the glyrends, which chosen is standard. The two enanthomers of glyceraldehyde were designated by D and L symbols as.

The D-configuration has "c'H attached to the carbon adjacent to "C'H₂OH group on **right** while L-configuration has OH attached to the carbon adjacent to "C'H₂OH group on left. Any compound that can be prepared or converted and D'+ "g-years/debyde will belong to D-series while any compound that can be prepared from or converted and L₄ - g-years/debyde will belong to L-series. This is based on the general principle that if a reaction does not profive the cleavage of a bond to the chiral centre, then the configuration about that chiral centre is retained. For

example. Dir glyceraldehyde can be converted into a glyceric acid by oxidation with Br, water and therefore the configuration of glyceric acid obtained will be D.

Summarly, +-Inche obtained from L. Eglyceraldehyde by the following sequence of reactions is assigned L-configuration.

It may be noted that D- and L- do not represent dextrorotatory or severateory. The optical activity of the molecule is represented by + and - which represent the direction of rotal into figurate polarized light whether device statory or severatory. This method has certain simulations. For example, sometimes the same compound can be correlated by sequences of reactions to a known L- compound.

However this method is still popular in brochemistry and brongy one is used to indicate the configuration of cataporates such as sugars, amino scide, etc. The D-series of sugars are those which have 40H group on the highest number stereo centre on the right in the Fischer projection and L-series of sugars—eve. 40H group on left

This method has been replaced by R and S method.

2. R and 8-system of Nomencluture.

The different etereorsomers of a morecule can be expressed to terms of R and S configuration. This method was proposed by Co at Ingold and Pretog. This method has been accepted by IUPAC It is based on the assignment of principles to the atoms or groups ettached to the central carbon. The priorities can be assigned on the basis of the following rules

Sequence rules

I If the four atoms is to seed. The chief current atoms are an different priority depends upon atomic number with the atom having higher atomic number getting higher priority and the atom having towest atomic number getting lowest priority. If we make at an apre of the same element the atom of higher makes number has the higher priority. For simplicity, these priorities may be written as 1 highest, 2, 3, 4 lowest). For example,



2. If the relative priority of two groups cannot be decided by rule 1 for the basis of the atomic number of the atoms that are directly attached to the asymmetric Γ atoms then the next atoms are considered for priority using where Γ For example, if ΓH_a and $\Gamma_a H_b$ are attached $\Gamma_a H_b$ gets priority becomes atoms attached to first Γ from are Γ H and Γ whereas in ΓH_a are ρ , atoms attached are Γ H, and Γ For example.

Simporty

CH, Cl
CH, TH C CH, Cl
/ H
/ 1.2-Dichlore-3-methyl butane

3-Chloro-2-methylpentane

(C) C. H of isopropy) take naturally over C. H. H of ethyl.

RM H of c = "group get priority over C, C, H of copropyl group because C1 has higher storic number than carbon,

Where there is a double bond or imple bond, both atoms are considered, a be duplicated or implicated. For example,

$$C = A$$
 equals $C = A$ equals $C = A$ equals $C = A$ equals $C = A$

For example, $CH = CH_n$ is treated as V and group

Isopropyl group

Н

Similarly, C = 0 has higher priority than $-CH_0OH$

Similarly R . H equals R ' H R—CH=CR, equals R CH CR, and

By this rive we get the following increasing order of poority

$$CH = CR_{c} < R -$$
 $< C = N < CH_{g} + H < C + H < C < C$ OH

Third rule is not commonly used.

Steps for Nomenclature

This method involves the following steps

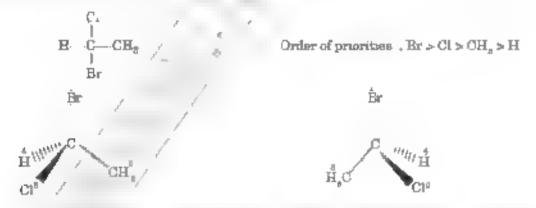
Step 1 Identify the centre or centres of characty in the molecule.

Step 2. The four alons or groups of atoms joined to the chiral carbon along are assigned a sequence of priority by the sequence rules. These are also called CIP rules as discussed above.

Step 3. After assigning the priorities to the four groups or atoms attached to the chira. C atom, the molecule is visualized to be in a position where the atom or group of atoms of lowest priority. 4. is directed away from us. Then we trace the path from the atom or group in the decreasing order of priorities. 4. if from 1 to 2 to 3,.

In doing so, if an eye travels in a clockwise direction the configuration is specified as **R** (for Laun; word rectus theam; gingly. However, I the eye moves in counter-chickwise directions, the configuration is specified as **S** (for Laun; word *massler*) meaning left).

Let us coust ler a simple molecule 1-bronto a charge lane. CH_CHCIBr



The molecule is now oriented so that the lowest priority group i.e.. His directed away from us.



Now trace the path from the atom or group in decreasing order of priorities e from $e \to 2 \to 3$ as



Counter-mockwise rotation S-configuration

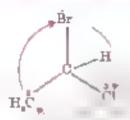
This may also simply be viewed as

Counter-clockwise S-configuration

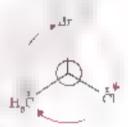
Let us consider some more examples

(i) Butan-2-oI : CH_CH_CHCH_

OH



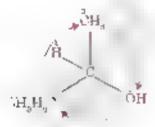
Cleekwas votstaan R-configuration



Clockwise R-configuration

Butan-2-ol

Priority order OH, CH, CH,, CH,, H



Clarkwise, R.

Counter-dockwise &

40 Lactic need CH, CH 200H

Counter-clockwise S

Priority proef OH, COOH, CH, and H

Clockwise, R.

(iii) 1-Amino ethanol CH₃ CH NH₄ Priority order to OH NH₃, CH₃, H OH

Clockwise R

Counter-clockwise 8

R

Note: If a molecule contains more than one chiral carbon atom, then the above procedure may be applied to each chiral curbon atom the by one. Let us consider the example of the following, son end? 3-bromobuten-2-of which contains two chiral carbon atoms 2 and 3.

Designation of configuration of C-2. After sampling the priorities, the configuration around C-2 can be predicted as shown below

Designation of configuration of C-9

The molecule may be represented as (2R, 8S).

Assigning Rand Sconfigurations from Foober Projections

Fischer projections are mad heapful to assign R and S configurations. These projects me are especially used in case of compounds containing more about one chiral centre. The following steps are followed

Step 1. Assign priorities to the four substituents to the usite way.

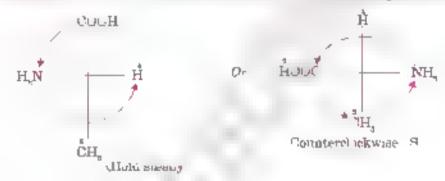
Step 3. Perform one of the allowed motions to place the group of lowest priority at the tilp of the Fischer projection. This means that the lowest priority group is oriented back $t \in away$ from the viewer as required for assigning configuration. Step 3. Determine the direction of rotation while going from $1 \to 2 \to 3$ of the remaining three groups and assign R or S.

These steps are explained below

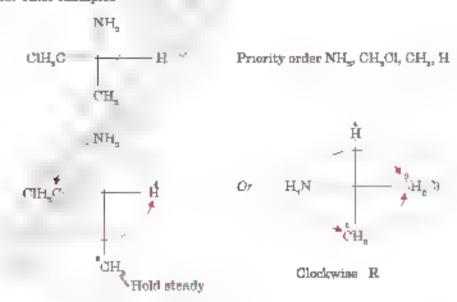
The priority order is NH,, COCH, CH, and H as



To bring the group of lowest priority. Hit is the top, bold the $-CH_p$ group steady and rotate the other three groups and then see the rotation from $z \to 2 \to 3$ since it is counter-clockwise. For rotation is S.

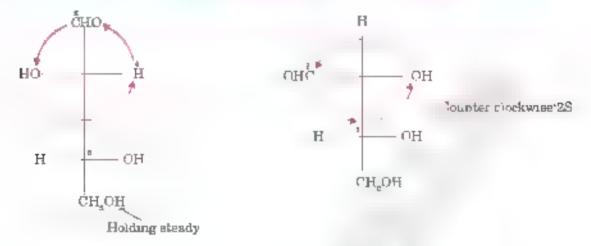


Similarly consider other examples

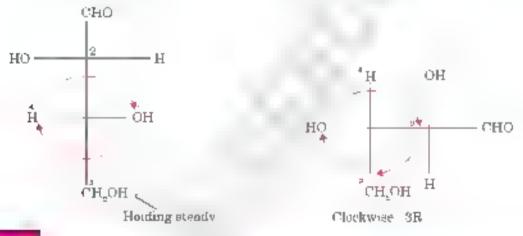


Let us apply to a morecule contaming two chiral centres.

Let use assign priorities on C-2 These are OH, CHO. C-attached, H



For C-3, proprity order is -OH, C attached, CH,OH and H

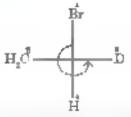


KEY NOTE

- There is a very simple way of predicting the configuration R or S) from Fischer projection.
- Assign prorities to four atoms or groups attached to the chiral centre.
- If the atom or group of lowest priority occupies vertical position upward or downward) in the Fischer
 projection then the observed configuration is the actual configuration of the molecule.
- I the atom or group of west priority now mes horizontal position right or left to the Fischer projection, then
 change are observed configuration from R to S or vice versa. This gives the correct configuration.

Liustration

The observed configuration is R. Souce H. les on horizones position therefore the artist configuration is S.



The observed configuration is S Since H use of vertice, position therefore, the actual configuration is same [8, S.

▶ DIASTEREOMERS AND MESO COMPOUNDS

Consider a compound with two different chiral carbon atoms. Each of these two chiral carbons can be either R or S and consequently there are four different ways in which these configure in making the arranged in a molecule. Thus, a molecule with two different chiral carbons can have four exercoisomers, in general. He total number of stereoisomers for a compound is 2^n where n is the number of chiral atoms. If there are two chiral carbons, then there can be upto four $2^n = 4$ exercoisomers and when there are three chiral carbon atoms. There can be upto eight $2^n = 8$ atereoisomers.

Consider for example a molecule of 2, 3-dibromo-pentane which has two chiral carbon atoms

(because H is on horizontal position,

(C 2 and C-3. Since there are two chiral carbon a onia, we expect four $2^{3} = 4$ attractions. Let us write structure I and its nurror image II.

We find that atructures I and II are non-super-impossible turror images. Therefore, these are **enantiomers**. Similarly, we can write structures II and IV. It is clear that structure IV is non-superimpossible airror image of LI. Hence, structures III and IV represent another pair of **chantiomers**.

Thus, structures I AV are all different and therefore, there are in total, four stereousomers of 2, 3-diffromopentane.

These are given below .

All these compounds are optically active compounds and therefore, are sterensomers. Any one of these, if placed separately in a polarimeter would show optically activity. The compounds represented by structures I and II are enanthomers and the compounds represented by structures III and IV are enanthomers.

Let us study sometre relation between structures I and III or between II and III. We observe that I and III or III are stereomorers but are not morror images of each other. The stereomores which are not mirror images of each other are called diaster-comers. Thus, diaster-comers are the stereomores which are not mirror images of each other.

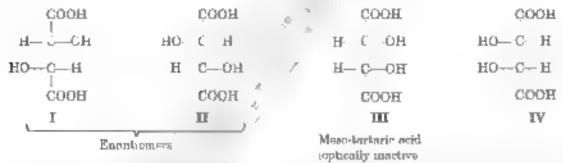
in the above example, I and III, II and III and armierly I and IV and II and IV are disastersomers.

Meso Compounds

A molecule with two chiral carbons will not always have four possible stereomers. Sometimes, there may be three may This a herouse some nonecules with the rai consider over overous actions. To understand this, let us consider a tartaric acid molecule which has two asymmetric carbon atoms

•си онсоон •си онсоон

Since there are two asymmetric carbon atoms, we expect four $(2^{\circ}, n)$ number of asymmetric C atoms) etersomers having the structures, I, II. III and IV as



Structures I and II are non-superimposable mirror image and thus are enanhomers. Structures III and IV are mirror langes but one structure can be superimposed on the other. This, the molecule is actural and hence a optically more se although a contains two asymmetric carbon atoms.

Meso form of tertame soid

This is called a meso compound. To is, meso compound is one whose molecules are superimposable on their mirror images even though they contain chiral centres.

Thus, meso compounds are optically mactive because they are achiral. In these molecules, there is a plane of symmetry one-half of the molecule is marror image of the other half. Thus molecule is and to have internal plane of symmetry and hence is achiral. Thus, tartain said exists in three optical isomers.

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions M. C. Q.

MULTIPLÉ CHOICE QUESTION? with only one correct answe.

Haloalkanes

- A1. The IUPAC name of (CH_{2'1} CO) is
 - a schore 1 1 1-trubummethene
 - b ?-chioro-2-methylpropane
 - 2-chlorobytane
 - Transchvihigzamethane
- All. The IUPAC name of CH,—CH CHCH,Br is

 - a 1-Bromobut-9-ene b 1 Bromobut-3-ene
 - c 2-Butene teoraide
- d 4-Broambut-2-ene
- AJ. In the reaction.

au, KOB - Intermediace CHICHCL

- a: OH,CHO
- 5 CH, CO
- JH,CH,OH
- d CH, CH,

OH.

- A4. For a given alky! group, the bailing points of alky! balides follow the order.
 - RI > RBr > RCI
- b RCI > RBr > RI
- .c) RI > RGl > RBr
- d) RBr > RI > RCl
- An. Which of the following as not a chiral 1
 - a 8-Methylherane
- (b) 9.3-Dihydronyjoopanmaand
- c) 2. 3-Diferencebutane
- rd) Buten-9-91
- Att. The reaction

Dry ether R R + 2NaX is called RX + 2Nn + RX

- (a Sandmeyer's reaction .b., Fittig reaction
- (c) Wurtz reaction / (d) Williamson's synthesis.
- A7. In the reaction

ok KOL X OL Y KON ZZA CH_CH_I

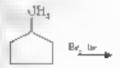
- a CHICH, CN
- b CNCH, CH, CN
- Brothathan
- # Br TH=CHON
- AS. In the reaction :

сн, снен,

- a) CH,CH,CHI
- 6 CH, CH -CH,
- c) CH_aCH = OH.
- d Ga, Ch Ch,
- A9. The reagents for the following conversions us'are

$$B_{f} \longrightarrow B = H$$

- (g) alcoholac KOH
- b. Zn CH,OH
- (c) aq. KOH followed by NaNH,
- (d) alsoholic KOH followed by NaNH,
- A10. In the following reaction.



The major product obtained is



- A11 In the addition of HBr to properly in the absence of peroxides. the first step involves the addition of
 - (a) H

(5) Br

.e) H^{*}

- A12. The major product in the reaction is

$$CH_{2} \hspace{-0.1cm} - \hspace{-0.1cm} CH \hspace{-0.1cm} - \hspace{-0.1cm} CH_{2}B_{\Gamma} \hspace{0.1cm} - \hspace{0.1cm} \frac{R_{2}D_{\Gamma}}{CH_{2}DH_{\Gamma}} \hspace{-0.1cm} \rightarrow \hspace{-0.1cm} \frac{R_{2}D_{\Gamma}}{CH_{2}DH_{\Gamma}} \hspace{-0.1cm}$$

a CH₃—CH—CH₃CH₅ b CH₃—C=CH₃ OCH.

v. CH₂-CH CH₂OCH₁ (d) CH₂-C-CH₃ OCH.

A13. In the reaction.

 $A \leftarrow \frac{C_2H_0\Omega R}{C_3H_0\Omega R} \qquad \{CH_{3/3}CBr \qquad \frac{C_2H_3D_1N_0}{C_3H_0\Omega R} \rightarrow B$ Magnet

A and B are respectively

- a A is (CH₂,C=CH₃ and B is (CH₂,COC,H₃
- b) A is (CH₃₋₁COC₂H₅ and B is (CH₃₋₁C=CH₂
- .e) Both A and B are (CH_{2/2}C---CH₂
- .d) Both A and B are CH₃₄COC,H₆

A14. In S., I reaction, the order of reactivity of balides in

- $a = 3^{\circ} > 2^{\circ} > 1 > methyl$
- b methyl > 1 > 2° > 3°
- 4r 3r > 2r = 1 > methyl
- d' 2° > 1° > methy) > 5°

A16. The product of reaction of alcoholic adver-intrate with ethyl brounde is

- (a) Ethylene
- (b) Ethylantate
- (c) Nitroethane
- d) Ethyl elcohol.

A16. C-X bond to strongest in

(e) CHÎCI

(b) CH,Br

(c) CHLF

(d) CH,I

- tal, andy one
- (b) two alkanes
- c) shree nikanea
- d) four withings

A18. 1.3-Dibramopropage reacts with metallic zine to form

- (a Propens
- .6) Propone
- (c) Cyclopropana
- d) Hexane

A19. Identify the set of rengenta/reaction conditions 'X' and 'Y' in the following set of transformation

Br

- a' X = dilute aqueous solution, 20°C:
 - Y = HBr/scetts and at 20%
- b X = dilute squeous NaOH % C.
 - Y = HBr/acetic acad at 20°C
- .c) X = diluta aqueans NaOH, 20°C:
 - Y = Br/CHCL O'C
- d X = concentrated alcoholic NatOH, 80°C,
 - Y Be/CHCL, O'C.

A20. Butese mirue may be propared by account

- a propyl alcohol with K 'N
- b) batyl alcabol with KCN
- c autyl diforide with Ks N
- (d) propyl chloride with KUN.

- A21. Which of the following will be senst renetive in nucleophilic substruction?
 - a) CH,CH,CH,CI
- $b = CH_{so}CC$
- .e) CH_=OH CH_Cl
- (d) CH_=CHOI

ARI. The reactivity order of halides for dehydrobalogenation is

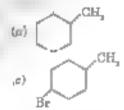
- σ R—F>R—C1>R—Br×R—I
- b) R-I > R-Br > R-Cl > R-F
- $g \in \mathbb{R} I \times \mathbb{R} \mathbb{C}I \times \mathbb{R} + \mathbb{R} g \times \mathbb{R} \mathbb{F}$
- d R-F > R-1 > R-B+ > R-4

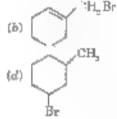
A20. Which one of the following gives only one monochloro derivative?

- .c) n-hexane
- 2-methylpentane
- c 3.d-dimethy)pentane
- ig, ineo-benreans

- a) CH,O-
- (b) C,H,O
- er (CH,),CHO
- (d) (CH₂₋₂CO-

A35. In the reaction, the major product 'X' is





Holoprenes

- A36. Chambenzene can be obtained from benzene diazoniam chlumde by
 - a Gattermann's reaction & Friedel Crafts reaction
 - (c) Wartz renction
- → Fitting reaction.

A27 Which of the following is most reactive cowards nucleophilic substitution reaction?

- (a) C_H_C1
- (b) CH_=CHCI
- ϵ CiCH,CH=CH,
- a CH CH=CHCL

A28. The reaction of toluone with "I. in the prosence of FeCi, gives predominantly

- (a) Benzoyî chloride
- (b) m-chloro tologoa
- ic Benzyl chiaride
- of or and problem where

A39. During the conversion

 $C_rH_rCH_rCH_r \xrightarrow{(a)} X \xrightarrow{(b)} C_rH_rCH = CH_a$ the respects α and b are respectively

A20. d)

- (a) SOCL ale KOH
- (b) CL/lw. H₀O

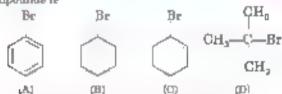
A21. d'

- e) 80,01, ag KDH
- (d) BO, CL, ale KOH

A22 8

- A₂8. b A₂4. α) A₂5. c A₂6. . A₁7. c A₂3. d) A₂4. (α) A₂5. b) A₂6. (α A₂7. (c)
- A28. c A19. b A28. (d) A29. d)

ASS. The increasing order of hydrolysis of the following compounds is



- a A < D < B < 0
- 6) A < B < D < C
- c) D < 0 < B < A
- d) A < B < C < D
- All: Arrange the following compounds in order of increasing dipuls moment

Totuene T), m-dichlarobenzene H, p-dichlorobenzene Hand p-dichlorobenzene (IV)

- a Is IV a F sall
- $H \times H \times H \times H$
- c) Tv ≤ I ≤ Ш ≤ Ⅱ
- $d) \quad IV < II < I < III$
- A32 The reaction of CH₂CH = CH OH with HBr

- ic · H. ("HBr("H₂ · □)—Br
- √d CH,CH,CHBr——Br
- A33. In the following sequence of reactions. B as

- a) ahlorobenzene
- (b) benzyl chloride
- .c) diphenyl
- (d) chlorophenylmethane
- A34. 2-Phenyi-2-chloropropane on treatment with air KOH gives mainly
 - a 2. Phenylpropens
- ,b) 3-Phenylpzypene
- 1 Phonylpropen-2-ni
- d .-Phenytpropan-3-o)
- A35. The major product Z in the following reaction is

CH.OH



BOOD, X BL RON Y B' B,D Z

- .a. Benzemide
- (b) Benanie seid
- c 2-Pheaylethmon scid
- d' Xylene

- A36. Fluorobensace is prepared by treating benzene discommon oblimide with fluoroboric acid and heating the product obtained. This reaction is known as
 - a) Schiemann reaction
 - b) Sandmeyer reaction.
 - Cathermann reaction
 - (d) Ulimann reaction.
- A87. Chlorobenzene is commercially prepared by
 - a) Etard resction
 - 5 Wurtz Pittig reaction
 - (c) Reachig reaction
 - .d) Gramart reaction.
- ASS. Chlorobenzens when heared with squeuus amounts in the presence of Cu_O under pressure gives
 - (a) Andline
 - b Diphenyl
 - ,c) Diphenylamine
 - d) Phenyl mocyanide
- A39. The structure of the major product formed in the reaction is

A40. Which of the following will give yellow precipitate on shaking with an equeous solution of NeOH followed by cardiffication with dil. HNO, and addition of AgNO, solution?

Polyhalogens

A41 Frem-12 is commonly used as

- o sun assertirude
- b) a refrigerant
- r ուցը[vɨŋ]t
 - d) lire extragualier

A42. Which of the following is the correct structure of D.D T?

- A40. Benzeue bezaultlonde samzed aa
 - a Dye

- Automalenai drug
- (c) Antibiotic
- d) Inserticide
- A44. When chloroform is exposed to light and damp air at gives among other renducts

 - to Carbon tetrachloride b Carbonyl chloride
 - sc) Mustard gas
- d) Carbon monoude.
- A45. D D T is prepared by heating chlorobenzens with
 - (a) chieroform
- (à chiore)
- (c) smarre
- (d) chloropserin.

A4E. (b) A42. (c) A45. (b) A48. (d) A44. b

MULTIPLE CHOICE QUESTIONS В from competitive Examinations

AJPMT & Other State Bourds Medical Entrance

B1. For the full wang

A. I.

(B) Ct

(0) Br

The mercaning order of ancicophilicity would be

- a) Cr < Br < F
- .δ) I ∈ Ch ∈ Br
- -c) Br < Cl < F
- $\epsilon D \cdot F \times Br \times Ch$

(CBSE Med, 2007

B9. In a 5_2 substitution reaction of the type

R - Hr + CI $\xrightarrow{OMF} R - CI + Hr$ which one of the following: has the highest reactivity rate "

- e CH_CH_Br
- d' CH,-CH,-CH,Br

T B S.E PMT 2008

B3. H_2 ($CH - CH = CH_2 + HB_7$ + A CH.

A predommantly is

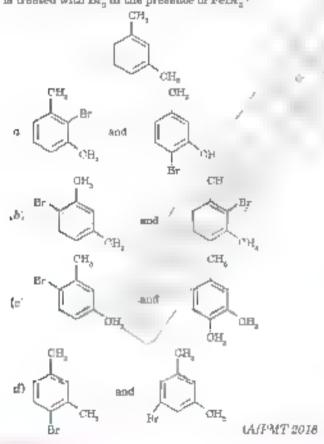
- (a) CH_B C—CH_BCH_B CH.
- (b) CH. CH_CH_CH_CH_ Br CH,
- (c) CH_a -CH—CH_e CH. Br
- of CHar CH-CHar CHaBr (C.B.S.E.P.M T 2008) CHa

B4. Which one is most reactive towards S_n1 reaction?

- or C.H. CICH, "JH Br
- .b, L,H, .H,Er
- C. H. CHIC, H. Br
 - d C.H. CH CH, Br

C.B.S.E PMT 2070)

- B5. The correct order of increasing reactivity of C-X bond towards ancieophile in the following compounds is
- B6. The reaction of soluene with Cl, in the presence of FeCl, gives X and the reaction in the presence of light gives Y. Thus, X and Y are
 - a) X = benzyl chlorule Y = m-chhorototuene
 - b^* X = benzal chloride, Y = v-chlorolologue
 - g) X = g; chlorotoluene, Y = g-chiorotoluene
- B7. What products are formed when the following compound is treated with Br₀ in the presence of FeBr₂?



B8. Which of the following compounds will undergo recommention when solution of KOH hydrolyses: ?

B9. In the reaction with HCl. an alkene reacts in accordance with the Markovnikov's role, to give a product 1-chloro-1-methylcycloheusna. The possible alkene is.

BIO. In an S_o1 reaction on chiral centres, there is

- er FUIS ratention
- h 100% owersion
- 100% гаселиганов
- (d) inversion more than retention leading to partial resembation. (AIPMT 2016)
- B11. Which of the following reactionts can be used for the preparation of alky! handes?

I CH,CH OH + HCl unbut ZoCl →
II' CH, CH,OH + HCl →
BI + CH, COH + HCl →
Iv + H, v. H H + H, \(\begin{array}{c}
\end{array}

- (o) IV) only
- b) (III, and (IV) only
- . I). (III) and IV) naly
- (a) (I) and II) only
 - AIPMT 9016
- B12. Which of the following is the most correct electron displacement for a nucleophilic reaction to take place?

(a)
$$H_{i,C} \leftarrow \stackrel{H}{\circ} = \stackrel{H}{\circ} \stackrel{H}{\circ} \stackrel{H}{\circ} \stackrel{A}{\circ} \stackrel{A}{\circ} \stackrel{A}{\circ}$$

(6)
$$H_i d \rightarrow \overset{H}{C} \stackrel{H_2}{\underset{H}{C}} d - d l$$

AJPMT 2015

Dr. (-)

85. (c) B6. d)

B7. .c.

B8 .d)

B9. (c) 1

B10. .d)

B.1. (c) B.2. (a

B18. The reaction of C.H.OH-CHCH, with HBr produces

(а С_вН_вСН_вСН_вСН_вВт

- c) C,H,CHCH,CH,
 - Вr
- .d) C.H.CH.CHCH.

Ble

(AIPMT R015)

B14. In which of the following compounds, the C—C1 bond comeation shall give most stable carbonium cm⁻¹

AIPMT 2015

B16. For the following reactions.

$$B^{r} \xrightarrow{H_{3}f^{*}} CH_{3} + KCH \longrightarrow H_{3}f^{*} CH_{3} + KEr$$

$$^{\prime}$$
 \bigcirc + Br_z \bigcirc Br

Which of the following statement in correct?

- Ameetimination, B and C are substitution reactions
- A is a substitution. B and i are addition reactions.
- A and B are etimination reachans and C is addition restricts.
- d' A is elemination. B is substitution and C'is addition reaction. NEET 2010.

Bit. Consider the reaction.

CHICHICHIBE + NOON - HICH, HICK + NABE

This reaction will be the fastest in

- (a) ethanol
- er methenou
- N N'-dimethylformanide DMP
- (d) water

OVERT ROLD,

B17. Which of the following hiphenyl is optically setive?

$$\begin{array}{c|c} c & & \\ \hline \\ c & \\ \\ c & \\ \hline \\ c & \\ \\ c & \\ \hline \\ c & \\ \\ c & \\ \hline \\ c & \\ c$$

NEET 9076)

B18. Identify A and predict the type of reaction. OCH,

B19. Hydrocarbon (A., reacts with bromine by substitution to form an alky), wounds which by Wurtz reaction is converted to gaseous hydrocarbon containing less than four earbon atoms. A. s.

- σ CH= H
- δ CHL=CH,
- e CH,-CH,
- d CH,

(NEST 2016)

NEET 2017

B20. The compound C.H. undergoes the following reactions

The product C in

- (a) as-heromoterlande
- b o-kromotolyona
- c. 3-bromo-s. 4 8-unchrorotoluene
- (d) p-bromotoluene

(IVEET 2018)

- B21. The hydrolysis of 2-brome-5-methylbutane by S.1 mechanism gives mainly
 - to 3-methyl-2-butenou
- b 2-methyt-2-butanol
- \$2-dimethyl-2-propanil
- 2-methyl-x-butanel
- 1-pentanol

- (Kerala P M T 2008-
- BSZ A dibalogen derivative X' of a hydrocarbon with three enriou atoms reacts with alcoholic KOH and produces another hydrocarbon which forms a red precipitate with ammuniacal Cu_Cl_ 'X' gives an aldebyde no reaction with aqueous KOH. The compound Wis
 - (a 1,3-Dichleropropane
- .6) 1.2 Dichleropropone
- 3,2-Dichloropropasie
- a . . Dichlaropropene
- (a) 1.3-Dichloropropend
- (Kerala P.M.T. 3008-
- B23. When neopentyl bromide is subjected to Wortz reaction, the product formed is
 - (a 2, 2, 4, 4-tetremethylhexane
 - (b) 2, 2, 4, 4-tetremethylpentane
 - (c) 2, 2, 5, 5-tstramethylberane
 - (d) 2, 2, 3, 3-tetremethylhexane
 - (e) 3 2 3 8-tetramethylpentone

Kerala Med. 2009.

B24. Arrange the following

CH,CH,CH,CI (I), CH,CH, CHCI CH, III JOH, OH CHICK (III and CHI, JOH CR (IV) as assure of decreasing tendency towards S_{1,2} reactions

- $p = 1 \times HI \times R \times IV$
- D II > [V > I >]
- (c) II > I > III > IV
- d) IV > III > II > I

ASIU SLIT

- B25. In alkaans hydrolyms of a tertiary alkyl halide by aqueous alkali, if concentration of alkali is doubled, they be recotion rate at constant temperature
 - to will be doubled
 - (b) will be halved
 - (c) will become four times greater
 - (d) will be trapled
 - (e) will remain constant

Ecrata P M T 2011

B16. An alkyl behde with moreoniar formula C.H., Br on dehydrohalogenation gave two moment askenes X and Y with molecular formula C.H.,

On reductive exemplysis, X and Y gave four compounds CH, COCH, CH, CHO, CH, CH, CHO and (CH, CHCHO) The askyl baside is

- (a) 2-beomohexane
- b 2 2-denethyl-z-hromolystane
- 4-bromo-2-methylpeninne
- 2-bronio-2 3-dimethylbutane
- (c) 3-bronto-2-methylpeutane

Kerala P.M.T. 2011

- B27. The compound that does not undergo hydrolysis by S. mediamen u
 - ch_-CHCH_Cl
- (b) C,H,Cl
- (c) C,H,CH,Cl
- (d) C,H,CH(CH,)Cl
- (a) C_H_CH(C_H_CCL

(Kerola P.M.T. 2011)

- R28. The major product formed when 2-bronn-2-methy/butane is refluxed with ethanolic KOH is
 - 2 2-methylbut-2-ens (b) 2-methylbutan-1-ol
 - 8-methylbman-2-m d i-methylbman-2-m
 - (a) 2-methy(but-1-ens Kerasa PMT 2014)
- R29. The total number of optical momers possible for 2. 8-dibromobutane is

.d) 3

- (0, 4
- c) D
- (e) S
 - Kerma PMT 2015)
- Which one of the following organohalogen compounds when beated with almhaba potassium bydramde does not undergo deliydrahalogenation reaction?
 - a) Becondary butyl chloride
 - b) Isopropyl chlorule
 - (c. Neopentyl chloride
 - d) Inobuty) chlorade
 - Tertany batyl chiomde

Korala PMT 20.8

JFE (Main) & Other State Boards' Engineering Entrance

BS1. CH, Br + Nur CH_Nu + Br

> The decreasing order of the rate of the above reaction with nucleophiles Nur A to D as

[Nur = (A, PhO , (B; AcO , (C) HO , (D) CH,O]

- a DorosBoA
- b As BoCoD
- e B>D>C>A
- .d) D>0>A>B

ALERE 2000

B82. The structure of the major product formed in the following renchan is

AIEEE 2008

B25. # B26. e) B21 (b) B22- (d B23. (c) B24. B27 .b B28. .a) B29. B30. c

B31. . B32. (c)

B32. Consider the following bromides:



The correct order of S_a1 reactivity is

- 信任 作っ円った
- B A>B>C
- (c) B > C > A
- (d) B > A > C, 4 , E E.E 2010.

B34. How many chiral compounds are possible on monochlorination of 9-methylbutage ?

ta S

.6. 4

(c) 0

- (d) 8
- (A.I.E.E.E. 2019)

(C)

B35. A solution of his charcoll phenylethans in to sens recent sectors and a discount of SbCi., due to the formation of

- (d) free radical
- (b) earbanion
- (c) carbeon
- (d) earbocation

JEE Main 2015)

B36. In S_2 reactions, the correct order of reactivity for the following compounds

CH₂OI, OH₂CH₂OI, (CH₂)₂CHOI and CH₂)₂COI is

- (a) (CH₁),OHCl > CH₂CH₂Cl > OH₂Cl > (CH₂,COl
- BOOK, TO SHOW SOME HATS OF DO
- A CHARLE HAR OH MOTE OH DO
- R CHOHO > CHO > CH 'OHO > CH'OO

JEE Mo.n 20.4

B87. In the resulton

$$\frac{NH_{s}}{\frac{N_{0}NO_{s}/HCl}{0.697}} D \xrightarrow{C_{0}CMRCA} E + N.$$

The product E as

FARE Moun 2015

- B88. The synchesis of alkyl fluorides is best accomplished by
 - .α Fackelatem resotion b
 - & Ewart's reaction
 - c. Free radical fluorosabuntoi. Bandinayer e reaction.

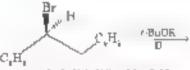
(JEE Moin 2015)

- a) (2R, 3S)
- (h) (2S 9R
- .c (2S, 3S)
- (b) (2R, 3R) (JEE Mein 2016)
- B40. 2 Ch.oro meth pen and on reaction with sodium methodol in methodol yields.

- CH
- nii of those
- b and B
- : III only
- b I and H WEE Mass 2016
- B41. The increasing order of the reactivity of the following halides for the S_o1 reaction is
 - - a) (III < III < I)
- (6) (II sel sell)
- .c (I) < III) < (II)</p>
- $(I \circ (II) \circ I)$

(JEE Main 2017)

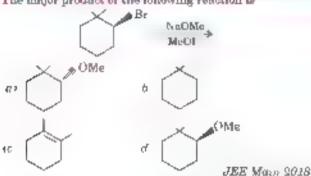
- B42. S-Methylpent-2-ens on reaction with HBr in presence of peroxide forms an addition product. The number of possible stereologisms for the product is.
 - a Bes
- (b) Zero
- e) Two
- ,d) Four
- (JEE Main 2017)
- B43. The major product obtained in the following reaction is



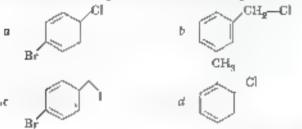
- $a \rightarrow C_1H_1CHCPBmCH_2C_1H_2$
- b) CH_CH=CHC_H,
- . + Ե_լҢԵԿ ԴՑաԵҢԵ_լҢ
- d) (-) C_4 H_4 C $H(O^*Bu)$ C H_4 C_4 H_5

(JEE Main 2017)

B44. The major product of the following reaction is

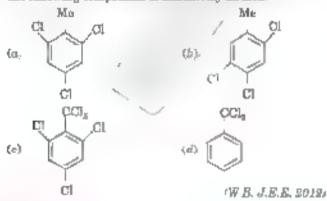


B46. Which of the following will give yellow precipitate on shaking with an agusous solution of NaOH followed by acadificanon with dir. HNO, and audition of AgNO, solution. ?



Origina JEE 2009

- B46. The alkene that will give the same product with HBr in the absence as well as in the presence of perceide is
 - a) 2-butene
- (b) 1-butene
- c) propens
- d) l-bezene
- a) 2-methylpropene
- (Kerula PBT #010.
- B47. When 3-phenylpropens reacts with HBr in the presence of peroxide, the major product formed is
 - 2-bromo-_-phenylpropane
 - b) 1, 2-dibromo-3-phenylpropane
 - c) 8-(o-bromophenyl)propens
 - d 1-bromo-3-phenylpropens
 - a) 3-(p-bromophenyl)propens (Kerata P E T 2011)
- B48. By passing excess of "Lig to botting of tone, which one of the following compounds as exclusively formed?



- B49. An alkyl bromide Xi reacts with sodium in other to form 4, 5-diethyloctane. The compound X is
 - (a) CH₁(CH₁,Br
 - 6) CH_a;CH_a;Br
 - e CH, H. CHiBrif H
 - d) CH,—(CH,),—CH(B₂)—CH,—CH,

Karnataka (ET 2015)

B50. Which of the following pairs are correctly matched?

Reactante		Products	
L	RX + AgrOH	=,_	RH
П.	RX + AgCN	÷	RNC
111	RX + Ki N _{edel}		RNC
IV	RX + No		R—R
·a)	I rlone		b Innd.I
-c	II and III /		.d' Hand IV Karnutako CET 2018

- B51. Which one of the following halogen compounds is difficult or re trydroxysed by S_m a mechanism ?
 - a) Tertiary butyl chloride
 - Isopropyl chloride
 - e: Benzy chumde
 - .d) Chlorobeazeae
 - (e) Allyl chiomde

(Kerala PET 2018)

Kerata PET 2014+

- B52. How many monochions structural isomers are expected in free rached monochlorination of 2-methylbutane?
 - 5 3 e) 4 क कि
 - .e) 6
- B58. The hydrolyans of optically active 2-bromobutana with
- aqueous NeOH results in the formation of
 - (-)-butem-2-od
- (b) (±≻but#1>2-0.
- + ньивалнано)
- ##binanian

Kamataka CET 2015)

The product of the above reaction is

WE JEE 2018)

- B55. The compound which is not formed when a mixture of a-butyl bromide and ethyl bromide treated with sodium metal in presence of dry ether in:
 - (a) Butane
- (b) Octab
- (c) Herana
- d) Ettane MH-CET 2016
- B56. The total number of monobelogenated products formed by halogenation of 2. 4, 4-trimethylhecane is
 - (a) 5

(b) 7

(c) (i)

d) 8

(e) 0

- Kerata PET 2016
- B57. The major product obtained by the addition reaction of HBr to demethylpent. Leas in the presence of periode is
 - (a) 1-bromo-4-methylpentane
 - b 4-bronto-2-mediylpertane
 - cc 2-bromo-4-methylpentane
 - (d) 8-teromo-2-methylpentane
 - (a) 2-bromo-2-methylpentage
- Kerala PET 2016
- BOK. Replacement of Cl of chlorobenzene to give phenoi requires directly conditions, but Cl of 2, 4-dankinchlorobenzene is readily replaced. This is because
 - NO₂ group makes the ring electron rich at ortho and ports positions
 - (b) NO, group withdraws electrons from meta position
 - (c) NO, danates electrons et meta position.
 - of NO₂ withdraws electrons from ortho and part positions. Karnataka C E T 2010
- B59. Toloune reacts with halogen in presence of iron III chlands giving artho- and para- halo compounds. The reaction is
 - to free radical addition reaction
 - b) electrophilic elimination reaction
 - (c) sucieopiulio substitution reaction
 - electrophabe aubstatution reaction.

Karnataka C E.T 9017

B60. The major product P formed in the follow or reaction as

Keralo P E T 2018

- - (a) I < II < III < IV / (b III < IV < II

 - s l < III < II < IV Kerala P E T 2017
- B61. Which if the following statement is true in case of alkyl handen?
 - " They are polar in nature.
 - They can form hydrogen bonds
 - .c. They are highly soluble in water
 - They undergo addition reactions

Kamiataka C.E.T. 2018.

- B63. n-Propyl chloride reacts with sodium metal in dry ether to give
 - a) CH,-OH,-CH,-CH,-CH,
 - b CH_CH_CH
 - CH,—CH,—CH,—CH,
 - d CH, -CH, -CH, -CH, -CH, -CH,

Kernataka (. E.T. 2018

- **B64.** Tertury alkyl bands is practically ment to substitution by $S_{\rm p}2$ mechanism because of
 - cr ansolubility
- (b) enstability
- anductive effect
- .d' atems handrance

Kamataka C.E.T. 2018

- B65. Neopentyl bromide andergoes delaydrohalogenation to give afkenes even though it ass no β -bydrogen. This is due to
 - .c. ES mechanism
 - b) E. mechanism
 - rearrangement of carbonations by E1 mechanism
 - a) ExCB medianism
 - E1 mechanism.

Kerola P.E.T. 2016)

- B68. The compound which does not lead to nitrile by substitution with NaCN/DMSO is
 - ar beazylatilande
- b) ethyl chlomie
- .e) uso-propyl chioride
- d) chlorobenzene
- .e) uso-butyl chloride
- Revara P.E.T. 9018

- B07. The number of possible organobromme compounds which can be obtained in the oblytic bromination of 1-butens with N-aromosuccanadade as
 - (a) 1

(b) 9

(c) 8

- d) 4
- W B J R E. 2018

JEE Advance) for HT Entrance

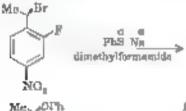
BOS. What would be the product formed when 1 frame-3-chloro cyclobutane rearts with two equivalents of metallic sodium in other?



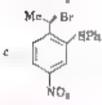


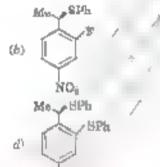


- (d) (LIT ROGS)
- B69. The major product of the following reaction is









(II.T 2008)

B70. The correct statement(s) about the compound given below

H₃C H₃CH₃

- a) The compound is optically active
- b) The compound possesses centre of symmetry
- (c) The compound possesses plane of symmetry
- (d) The compound possesses axis of symmetry

LIT 9008

B71. KI in sections, undergoes S_2 resetion with each of P. Q. R and S. The gaves of the resetion vary as

- (a) P > Q > R > S
- .b; 8>P>R>Q
- (c) P>R>Q>S
- (d) R>P>S>Q

(JEE Advance 2018

B72. In the following reaction, the major product is

H,C

(o) H_tO H_t

(b) H_sC Ar

. H.C. BI

a H.C Br

JEB Advance 2018)

B87. (d) B88. (d) B89. (a) B70. (a) B71. (b) B72. (d)

C MULTIPLE CHOICE QUESTIONS with more than one correct answers

- C1. Dipole moment is shown by
 - a) Benzoyl chromde
 - b) cas 1 2 dichloroethene
 - c truce I 9-dubliomethene
 - d' trans 1 2-dichloropent-2-ene

- C2. Aryl halides are less reactive towards nurleophilic substitution reaction than alkyl halides due to
 - a) the formation of less stable carbonium ion.
 - b) resonance stabilization
 - (c) longer carbon-nalogen bond
 - d) sp²-hybridised carbon attached to halogen

Ca. In the reaction

- (a) Pentaga 2-oga
- ,6' Acetophenone
- tc) Hesane-9, 6-dione
- (d) 4-keta pentanure scid

C4. Beazyl chloride can be prepared from toluene by chlorination with

- (a) \$0,0t,
- 6) SOCL
- (c) CL, he
- .d) NaOC1

C5. A new carbon-carbon bond formation is possible in the following reaction/reactions.

- (a) $C_0H_0 + OH_0CI \xrightarrow{A[O]_{L\to 0}}$
- 6) CH₂CH₂Br + CH₂CH₂NH₃
- (c) CH,CH,Br + No OCH,
- (d) CH_CH_Br + KCN(ele.) -

C6. Which of the following statements are correct?

- (a) Bearyl halides are more reactive than vinyl and aryl halides
- (b) Vinyl halides are more reactive than elkyl halides
- (c) Aryl halides are less reactive than alkyl halidee
- (d) Aryl balides are more reactive than benzyl babiles
- C7. Which of the following contain sp² hybridized carbon bonded to X?

C8. Compoundle, that on hydrogenation produce's optically markets compound(s) ware)

JEE Advance 2016

C9. The IUPAC name/s of the following compound is .nre?

- (z) x-chiero-4-methylbenzene
- .b) 4-chierotelnane
- 1-methyl-4-chrombenzene
- (d) 4-methylchlombenzene.

JEE Advance 2017)

(10. For the following compounds, the correct statement(s) with respect to nucleophilic substitution reactions is (are

- (a) I and II follow 8,2 mechanism
- b' compound IV undergoes inversion of configuration
- .c' the order of reactivity for I, III, and IV as IV > I > III
- .d) I and III follow E, I mechanism.

JEE Advance 90.7

C3. cd

C7 b. d' C8, b. d

C10, 0 b, d

D | MULTIPLE CHOICE QUESTIONS based on the given passage/comprehension

Passage 1.

Alky thurdes undergon, wheophy is substitution constitute in which belogen when is replaced by other arom.

$$RX + Nu^* \longrightarrow NuC \longrightarrow R + X^*$$

These reactions follow S_n1 and S_n2 type mechanism in which S_n1 takes core in two states while S_n2 takes place in single step. Due to their tendency to independent to an angle or arge number of nucleophases, they form a variety of products.

Answer the following questions

- D1 In which of the following pairs, the first nucleophile is alreager?
 - .e) Ct. I
 - b CH OH CH,5
 - (c. (CH,CH,),NH, (CH,CH,),N
 - ra ch_eo dh_eN
- Els. Which of the following is least reactive towards S_a2 mechanisms:
 - g) CH_,CHCH_Br
- 6 CH_{eff}CCH₃Br
- (c) CH,CH,Br
- (d) (CH_{ab}CHBr

- D8. In which of the following pairs, the first compound a setter $S_{\rm g} 2$ substrate 4
 - so I bromo a-methyl cyclohexane cyclohexyl bromide
 - (b) 1-rodo-2, 2-dimethyl propans. isopropyl rodide
 - (c) 2, 2,-dimethyl-1-chlorobutane. 2-chloro butane
 - (d) isopropyl bromide, 2-bromobutane
- D4. In which of the following ancisophine substitution reaction, the product formed is recenif matter?
 - (a. CH, 5CBr
- (b) CH,CH,Br
- (c) (CH₂CH₂), CHBr

A NE SCH C

- (d) C,H,CH,Br
- D5. Which of the following has highest nucleophibity?
 - (a) SH

(b) H₁O

(c) DH

(d) F

Passage II.

A chlorocompound (A, on reduction with Zn-Cu and athanol gives the hydrocarton B) with five carbon atoms. When A is dissalved in dry ether and treated with sodium metal it gave 2.2.5.6-tetra methyl because The treatment of A as

Answer the following questions

- D6. The compound A is
 - a arthure-2 2-dimethy propone
 - 5 1-chlore-2 2-dimethyl butane
 - el a-chiero-2-methyl became
 - (d) 2-chioro 2-methyl butane
- D7. The reaction of C with Na. C.H.OH gives
 - (a) (CH_{1/2}C CH, CONH,
 - b) (CH, , C NH,
 - (e) CH, to CH, NH.
 - ab (CH, OHCH,NH,
- D8. The reaction of C with Nn, C3H4OH is called
 - .c) Gilman reaction
 - b Metidatia resistanti
 - Спосува распевы
 - .d) Swart's resoluci
- DO. The restion of A with eq. KOH will preferably favour
 - a) B_al mechanism
- S₂2 mechanism.
- (c) E,mechaniam
- (d) E, mechanism

BS. (d) D4. (a) D5. (a) Passage H D6. (a) D7. (c) D8. (b) D9. (a)

Assertion Reason Type Questions

The question given below consist of an Assertion and the Reason. Use the following key to classes the appropriate maswer

- a If both assertion and reason are CORRECT and reason is the correct explanation of the assertion
 - b) If both assertion and reason are CORRECT but reason is NOT THE CORRECT explanation of the assertion.
 - c) If assertion as CORRECT but reason as INCORRECT
- d) If assertion is INCORRECT but resson as CORRECT
- g) If both assertion and renow are INCORRECT
- Assertion: Addition of Br₁ to but-1 -see gives two optical isomers.
 - Reason z The product contains one asymmetric carbon atom.
- Assertion: S_g2 reaction proceeds with inversion of configuration
 - Reason S_N2 reactions occur in one step.
- Assertion. Addition of Brito trans-2-nuteric yields meso-3.3-dipromobutane
 - Resson Bromme addition to an alkane is an electrophib.

 addition reaction. (1 , T 2001)

- 4. Assertion: Benryl bromids when kept in acatons-water.
 At produces benryl micohol
 - Reason The reaction follows S_a° machamam.

AHMS 2008

- Assertion: The nucleophilic substitution of vinyl chloride
 is difficult than sthyl chloride.
 - Reason Vmyl group is electric donating group
- Assertion. tert—buty, bromide undergoes S_N1 nucleophiae substitution readily than n-butyl bromide.
- Reason It proceeds by the formation of stable carbocation

 7 Assertion Ethanol gives indeferm test while methanol
- does not.
- Reason Ethanol is less reactive than methanol cowards undecophibe addition reactions.
- Assertion Treatment of choroethane with a antionted solution of AgCN give ethyl motyamide as the major product
 - Remon : Cyrindeton (*CN* is an embident nucleophile.
 (AIIMS 2014)
- 9. Assertion 2-Bromobutane or reaction with substantiethouse or ethnologies 1 but save as the major product.
 - Reason 1 Button ens is more stable than 2-test-2-ene
 AIMS 2009
- Assertion Alkyl include can be prepared by treating alkyl chromide/brounde with Nai in acctone
 - Reason: NeCl and NaEr are soluble in sections but NaI
 is not.

 AIIMS 2007)



i. (a, ii. (b) d. (b) d. .c) fi. (c) fi. (a, 7. ,b ii. b) 9. (v) 10. .c

Integer Type Questions

The answer to each of the following question is a singledigit-integer ranging from 0 to 0.

 The number of compounds aboving sometioners among the following compounds is

Bucan-9-or % Hydroxypropanous and 2-Methylliexane. 9-Charobotane % Brown-2-chorobotane.

- 2 Methylbutanose acid, isopropyl chloride
- The number of reactions proceeding through free reducal mechanism are

$$_{i}$$
tt $C_{j}H_{k}Br+AgCN$

$$AA' = C_aH_aCH_a + CL_ah\nu$$

3. In how many pairs the first compound reacts faster than the second in S_2 reaction with OH?

$$m$$
 CH₂O₁ OH₂OC1

4. In how many pairs, the second compound reacts feater than the first in $B_{\mu\nu}$ reaction with OH 9

- m) (CH_{a'},CHBr, CH,CH,Br
- The number of moment having the molecular formula C,H,,Br is
- The total number of alkenes possible by dehydrobrommation of 3-bromocyclopentylliexane using alcoholic KOH is
- 7 In the following monobrommetion reaction, the number of possible chiral products at



Exemplar Problems



Objective Questions

Multiple Choice Questions (Type-I)

 The order of reactivity of following alcohols with hatogen. ат арти

 $CM_{\rm H}$

B CH,CH, TH OH

CH₂CH₂ -C OH

CH_a

CH.

a A > (B > 1' C B > 4 > 1

 Which of the following alcohols will yield the corresponding. advyl chioride on reaction with concentrated HCl at room temperature 7

a CH,CH, CH, OH & Ch,cll, CH OH

CH,

CH.

CHICH, CH CHICH of CHICH, C-CH

CH.

Identify the compound Y in the following reaction.

- 4. Toluene reacts with a nelogen in the presence of iron ... chloride giving ortho and pare halo compounds. The
 - .a' Mecrophilis elimination reaction.
 - Electrophilic substitution reaction.

- c Free redical addition reaction.
- d Nucleophrise substantion reaction
- 5. Which of the following is hangen exchange reschou? p RX + Nal PR + NaX

$$c R H + H \lambda \xrightarrow{Z_D \cap I_D} R X + H_i \cap$$

6 Which reagont will you use for the following reachan? $\mathrm{M}_{\mathrm{C}}^{\mathrm{C}}\mathrm{H}_{\mathrm{C}}\mathrm{H}_{\mathrm{C}}\mathrm{H}_{\mathrm{C}}\mathrm{H}_{\mathrm{C}} = + \mathrm{C}\mathrm{H}_{\mathrm{C}}\mathrm{C}\mathrm{H}_{\mathrm{C}}$ CH,CH,CHCCH,

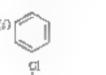
(a CL /UV aight

6 NaCl + H.SO,

el CL, gas in dark

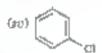
a) CL, gas in the presence of arm in dark

7 Arrange the following compounds in the unreasing order. of their densities,









< 0 < 0 < 0.

8 4 11 4 6 4

(e)(ie) < (iii) < (iii) < (ii)

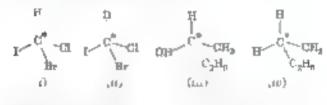
d n < 10) < 41) < 1)

8. Arrange the following compounds in increasing order of their boiling posite

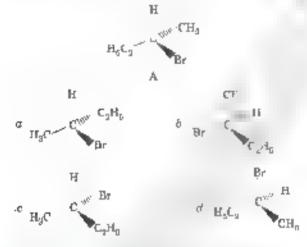
,in
$$H_3C - \dot{C} - CH_3$$

Br

9. In which of the following molecules carbon atom marked with asteriak (*) is asymmetric ?



16. Which of the following structures is enantiomeric with the molecule A) given below?



- 11. Which of the following is an example of vic-dilialide?
 - a Dichioromethane
- .b. 1,2-dichtoroethane
- (c Ethyhdene chioride
- (d) Allyl chroride
- The position of Br in the compound in CH, CH=CHCtBr. CH,), can be clearfied as
 - a Allyl

b Aryl

.c. Vmvl

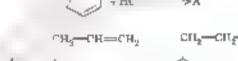
ad Secondary

- Intermediate is formed by reached of chiefine with benzene in the presence of A.C., Which of the following species attacks the bearene ring in this reaction ?
 - to Ch

(6) (IL

et AICL

- (d) [AJCL:
- 14. Ethylidene chitmide in s/so.
 - a pic-dilustide
- to gem-dibalide
- e) allylie balide /
- (d) vanyba hahde
- 15. What is A in the following reaction?







- 16. A primary asky hands would prefer a undergo
 - a S_{er} teaction
- (b) 8,2 reaction
- c 14- Eկաստուրա
- (d) Recemiesbon
- 17. Which of the following alkyl halides will undergo $S_{\mu\nu}$ reaction most readily?
 - to (CH_e, C—F
- (b) (CH,,, C-CI
- e) (CH_{e1}, C—Br.
- (d) (CH,, C-I
- 18. Which is the correct IUPAO name for

- (a 1-Brown-2-ethylpropage
- 6 1-Bronti-k-ethyl-2-methylethane
- c . Bromo-2-methyfhulane
- d 2 Methyl-1-bromobutane
- 10. What should be the correct IUPAC name for disthylbromomethane*
 - a Bromo 1 desthylmethans b 3-Bromopentane
 - .c) 1-Bromo-1-ethylpropans
- (d) 1-Bromopeotane

20. The reaction of talcene with chlorine in the presence of arm and in the obsence of aght yields



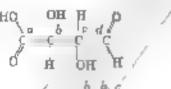
e H_sc C

d' Mixture of m and s n

 Ohi momethane on breakment with excess of ammonia yields meanly

a N. N-Dimethylmethaniamine "H₃-N CH₃

- 5 Nomethylmethenomine CH₁, NH—CH₃,
- e Methanamme "H,NH,
- d' Mixture containing au these in equal proportion
- 33. Molecules whose unirror image is non superimposable over them are known as chiral. Which of the following molecules is chiral in nature?
 - a 2-Bromobutane
- 5 Alternobmane
- с 2-Вготоргорана
- (d) 2-Brownpropen-3-of
- Reaction of C₄H₅ ™₅ Br with aqueous aidious hydraude follows
 - .e S_e1 mechanism
 - (b S, 2 mechanism
 - ,c Any of the above two depending upon the temperature of reaction
 - (d) Seytzeff rule
- 24. Which of the carbon atoms present in the motecule given below are asymmetric?



,a a b c, d (c) a, d

- (d) a, b, c
- 25. Which of the following communits will give receive nexture on nucleophilic substitution by OH: con?

В

(ns) CH_a: -CH₂ -CH₃Br

 $\dot{C}_{a}H_{a}$

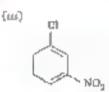
a) (r

a secondary

(e) (iii), (iii) d' (t), (iii)

Note : In the questions 25 to 29 arrange the compounds in increasing order of rate of reaction towards nucleophoic substitute.

96. (i) ot Nn₂



...

b a c c c

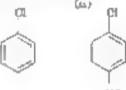
97, and GI CH,

G H³

d < 1, < 1,

D = 10 = 1

98. (i)

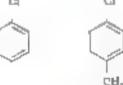


(iii) CI NO2

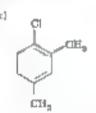
(a) (ai) < (ii) < (i)

(b) (ai) < (aii) < (i)(ai)

99. (f)



(iii)



(a) (i) + (a) + (ii)

- (b) (a) \times (i) \times (iii)
- (e) \sqrt{n} < (in) < (in) < (in) < (in)

- 80. Which is the correct increasing order of boiling points of the following compounds?
 - . Jodobutane, 1 Bromobutane, 1-Chlorobutane, Butane
 - a Batane < . 'h probuenne < . Bromobatane <
 - A) I-Todobutane < I-Bromobutane < 1-Chlorobutane < Butane
 - (c Botane < 1-Indobutane < 1-Bramobutane < 1- blurobutane
 - (d'Hutane < 1-Ohlorobutane < 1 Iodobutane < L'Branchutane

- 31. Which is the correct increasing order of boiling points of the following compounds?
 - 1-Bromoethans, 1 Bromopropans 1-Bromobutane.
 Bromobenzene
 - (a) Bromotenzene < 1 Bromothane < 1 Bromothane < 1 Bromothane</p>
 - b Eromobeazene « . Bromoethane « 1 Bromopropana « 1-Bromobutana
 - 1-Brumopropone Brancontane < I-Brumoethane <
 Brumobenzene
 - of 1-Bromosthane < 1-Bromopropane < 1-Bromobutane < Bromobenzene

b' Intermediate su us unatable because carbon atom is

- Intermediate (10) is stable because carbon atom is

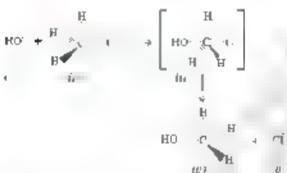
d Intermediate (c) is seen stable than the reactant

Answer Q. Nos. 35 and 36 on the basis of the following

30. (a) 31. (d).

— particular formation (form) — (())

Note it In the following questions two or more options may be correct. Consider the following reaction and answer the questions no. 32-34



i) (a) (iii) (a)

35. Which of the following statements are correct about the mechanism of size reaction?

ap hytondised

see hybridased.

cenetaco.

- a A carbocation will be formed as an intermediate in the reaction.
- b H will attach the substrate u from one side and Cf will leave it simultaneously from other side.
- c' An anstable intermediate will be formed in which OH and CI will be attached by weak bonds
- ,d) Reaction proceeds through 8,1 succhanism.
- 36. Which of the following statements are correct about the kinetics of this reaction?
 - a The rate of reaction depends on the concentration of only .n
 - b) The rate of reaction depends on emcentration of both ϕ and μ
 - c) Molecularity of reaction se one
 - an Malecularity of reaction is two

32. Which if the statements are correct about above reaction?

- as (i) and (o) both are nucleophiles.
- b lo (nt) carbon atom is sp^a hybridised.
- c in (as) earbon atom is ap hybridized
- (d) ... and (v both are electrophice
- 39. Which of the following statements are correct about the reaction?
 - a The given reaction follows 8,2 mechanism
 - b .ul and (co) have opposite emifguration.
 - c (a and se) have some configuration
 - d' The given reaction follows 5_1 mechanism
- 84. Which of the following statements are correct about the reaction intermediate?
 - z Intermediate us as ansiable because in this carbon is attached to 5 atoms.

84. (a., d)

- 87 Halonikanes contain halogen atom as attached to the ept hybridised carbon atom of an alkyl group. Identify halonikane from the following compounds.
 - a 2-Bermorentane
 - .b Vinyl chloride chlornethene;
 - 2-chloroncetonheaune
 - d' Trubiomoiethane
- 88. Ethylene chloride and athylideue chloride are somers. Identify the correct statements.
 - Both the compounds form same product on treatment with alcoholic KOH
 - b Both the compounds form same product on transment with eq. NsOH
 - (c. Both the compounds form same product on reduction.
 - td' Both the compounds are optically active
- 89. Which of the following compounds are gem-dilables?
 - a Ethylidene chloride
- 6) Ethylene dichloride
- (c Methylene chloride
- d) Benzyl chloride

- 40. Which of the following are secondary bromides?
 - o H. HBr
- 6 (H,) O H,Br
- M₂, H(BrX, H₁, H₂)
- a CH, CBrCH CH,
- 41. Which of the following compounds can be classified as anyl halides?
 - o parich, third on a
 - b participation of a first this
 - clo-BrH, CACH, CH, CH, CH, CH,
 - of CaH, Cl
- 42. Alkyl halides are prepared from alcohols by treating with
 - (a HCl + ZnCl,
- (b) Red P + Br.,
- e' H,60, + KI
- (d) All the above
- 48. Aikyl fluorades are synthesised by beeting an alkyl chloride/bromide in presence of or
 - (a₄ CaF₂
- 300 (d)
- c Hg.F.
- (d) NaF



37 (a) .d) 38. .a., (c) 30. a, (c) 40. (a) c 41. u d 42. a 5 48. b, (c.

- 23

Ministracy Court Compression



Note \imath Match the items given in Column I and Column II in the following questions:

44. Metch the compounds given in Column I with the effects given in Column II

Column I	Column II
a Chioramphanion	(i) Malaria
b Thyronia /	(tt) Anaesthetic
(c Chiorogumé	(str) Typhoid fever
(d) Chloruhron	(w) Gotter
2	.e) Blood substituent

45. Match the stems of Cohumn I and Cohumn II

Column I	Column II
.α S _a 1 reaction	(a) trac-dilherandes
b Chemicals in fire entanguaher	(it) gem-dibahdea
.c Brommation of alkenes	(iii) Recemiestion
(d) Askylidene halides	(co) Sayteell rule
e Khamation of HX from alkylinkide	e) Chlambranaesthous

46. Match the structures of compounds given in Column I with the classes of compounds given in Column II

Column 1	Column II
σ CH ₀ CH CA ₀	Aryl hnude
X	
.b) CH, CH-CH,-X	ជោ Alkyl helide
Х	
	(iii: Vinyl halide
(d) CH ₃ — CH-X	(in: Allyl helide

47 Metch the reactions given in Column I with the types of reactions given in Column II.

	Column !	Column II
ק		Nacteophilir aromatic enteritarion
ь	CH ₂ CH = CH ₂ + HBr → CH. (H CH ₃ Br	Electrophiae arometic substitution
(c)	CH ₂ −CH ₂ −1	Seftrell spanaghar
t,	CI OH NO ₂ + NaOH	.w. Electrophilic addition
뇐	си,си, си си, ас к. Т. з си,си — си си, Вт	o Nucleophibe substitution. S _n 1

48. Match the structures given in Cultum I with the names in Cultum II

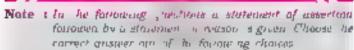
Column I	Column G
iir	
a	.s 4-Brittopent-2-ene
b Er	12, 4-Bromo-9-mathylpent-2-ene
of Lar	na'l 1-Brome-2-methylbut-2-ena
(d) Br	I Bromo-2-methylpent-2-ene

49. Match the reactions given in Column I with the names given in Column II

Column I	Column II
« X + RX NB → R	: Fittig reaction
×	
0 2 - 25a Eliter + 258X	Wurtz Fittig resolate
(c) $\hat{N}_{x}^{X} = \mathbb{E}_{\mathbb{P}_{x}^{X}}$	a) Fukeliten rectur.
(d) $C_1H_1O1 + NaI$ $\xrightarrow{Doj \text{ contract}} C_2H_1I + NaCi$	ne) Sandmeyer reaction

48. a) (a) (b) (ua) c) (u) (d) (w. 40. (u, u) b) (i) (c) w) d) (at

- Receiler and Repaintings Quarties



- Asserbin and reason both are correct and reason is correct explanation of assertion
- 5 Assertion and reason both are wrong statements
- to Assertion is correct but reason is wrong statement.
- (d' Assertion is wrong but reason is correct statement.

- Assertion and reason both are correct statements but reason is not correct explanation of assertion.
- 50. Assertion Phosphorus chiomdes (tri and penta) are preferred over through chiomde for the preparation of alkyl chlorides from alcohols.

Resson Phosphorus chiorides give pure aikyl dalides

51 Assertion The boiling points of alkyl natides decrease in the order

RI > RBr > RCl > RF

Remon: The boiling points of sikyl chlorides, bromides and indides are considerably higher than that of the hydrocarbon of comparable molecular mass

- 62. Assertion : KCN reacts with methyl chloride to give methyl isocyanide Reason : CN: is an ambident nucleophile
- 63. Assertion terr Buryl promide undergoes Wurtz reaction to give 2-2, 3-3-tetramethylbutane.
 Reason t in Wurtz reaction alky buildes react with sudain in dry ether to give bydrocarbon containing double the number of carbon atoms present in the halide.
- 54. Assertion . Presence of a mitro group at ortho or para position increases the reactivity of belowence towards nucleophilic substitution.

Reason t Nitro group, being an electron withdrawing group decreases the electron density area, he henzene ring.

- 55. Assertion In monohanderenes, further electrophilic substitution occurs at ortho and pera positions. Reason : Helogen atom is a ring descrivator.
- 66. Assertion Aryl todades can be prepared by reaction of arenes with todate in the presence of an oxidiating agent oxidiates I, into HI.
- 57 Assertion III is difficult to replace chlorine by OH in chlorobenzene in comparison to that in chloroethane

 Reason Chlorine-carbon C+Ct aund in chlorobenzene has a partie, duable aund character due to resonance.
- 58. Assertion: Hydrolysis of >2-bromocetane proceeds with inversion of configuration.
 Reason: This reaction proceeds through the formation of a carbocation.
- 69. Assertion : Nitration of chlorobonzene leads to the formation of or-nitrarblumbenzene Reason : NO, group is a m-directing group



52. (d) 58. (a)

54. (a

55. e

56, (4)

57. (a

58. .c

19. ...

Hints & Explanations for Difficult Objective Type Questions

A. mcq with only one correct answer

As. c): CHaCH=CHCH2Br 1-Bromobut-2-ens.

A3. (a):
$$CH_1CHCL_1$$
 PQ_1ROH_2 CH_2CHC CH_2CHC OH CH_2CHC

AB. of Simple alkyl balides are dehydrobalogenated by using a strong base such as all K. H. But may base require much etronger base such as NaNH, for dehydrobalogenation

$$\begin{array}{cccc} CH_1 & CH_0 & \xrightarrow{adc. KDK} & CH_1 & CH & \xrightarrow{NaNH_1} & HC = CH \\ Br & Br & Br & Br & Br & \\ \end{array}$$

A10. Get Bose of obstraction of H is 3" > 2" > 1" Therefore, option is in current



- Also to the absence of permandes the first step of the electrophilic addition set H to form corbocation
- A12. b t CH₂O is a strong nonleophile as well as a strong base. Therefore, it can enter imag about a substitution or elemination. Since the CH₂ group at β-carbon courses atsent andrease to aucleophiae substitution. S₁2: therefore, elemination occurs preferably to form 2-methylpropens as.

- A13. (b) With a weak nucleophile such as C₂H₂OH substitution takes place ε form text-buty ethy either CH εC+C +C H₁ A₂ With a strong base take C₂H₁ ε Pert-buty; brounds undergoes shown that is of form CH₂ CH₂ B
- Alfi. (a) CH₂CH₂Br + AgNO₂ + CH₂CH₂—N
- A1d. (c) due to high bond this occation energy
- A17. c forms three products pentage, butage and because

- AS. sal. The baloged atom in vinyl chloride is least reactive
- A22. (d) Neo-pentane has all the Historia equivalent and therefore gives only one monochloro derivative

- Neopentene
- A14. (a Smaller the size of the nucleophile s.e., CH,O+) more reactive it is.
- A35, 467 Allytic brommetion occurs as

The double bond within the ring endocyclic radical H is more stable than the double bond outside the ring excevely radical. Therefore, the less stable free radical + gets converted into the more stable free radical H which then reacts with Br, to give the product

A26. α Chlorobenzene can be obtained from beuzene diazonium chionde by Sandmeyer's or Gattermann reaction.

$$N_{\lambda}^{+}Cl^{-}$$
 (3)
$$O_{N_{\lambda}}RCl^{-}$$

$$\longrightarrow + N_{\lambda}$$
 Gettermenn reaction,

A39.
$$A = C_s H_s C H_s C H_s = \frac{90 \sqrt{L_0 t \alpha}}{90 \sqrt{800}} + C_8 H_8 C H C H_s = \frac{ab}{R(t)} + \frac{KOR(d)}{R(t)} + C_4 H_s C H = C H_s$$

$$C I$$

A30. (d) : This is in accordance with the stability of the carbocation as

$$^{\mathrm{CH}_{1/2}\mathrm{C}^{\mathrm{C}}}$$
 $\overset{+}{\bigcirc}$ $\overset{+}{\bigcirc$

OI

A38,
$$c + 2$$
 $Cl_2 \rightarrow 2$ N_0 Fitting reaction Dipheopi

CH. -

CH,OH OH,OI CHLON CH,COOH ale Ko N 2-Phenyletteanaic acid CI

Artiline

Alloy balides are more reactive than any) habdes and cherefore, only the side chain balogen. Class displaced

A40. Alkyl balides are more reactive than arythalides, α and α are arythalides and therefore less reactive than alkyl balides 5 and a Suice prempitate has yellow colour at most be Agu So, option ic is correct

Asc. (b) :
$$CHCl_0 + \frac{1}{2} \cdot O_0$$
 $\Rightarrow COCl_0 + HCl$

Carbony)

chloride

B, mcq from competitive examinations

- B1. (a) The nucleoph-limity increases as Ol; < Br < I'
- B2. c : Rate of S_p2 reaction decreases with increase in steams hindrence. Since "H_p" H_pBs has the least steams hindrence, it reacts at the fastest rate

B3. (a) :
$$CH_1CH_1 - CH_2 + HB_7$$
 Br $CH_2 - CH_3 - CH_4 - CH_4 - CH_5 - CH_5 - CH_6 - CH_6$

B4. (a) For S_{NA} reactions, more stable is the carbocation, more reactive, we niky in any baside. The stability of carbocations increases in the order.

 $C_0H_0\dot{C}H_0 \leq C_0H_0\dot{C}HCH_0 \leq C_0H_0\dot{C}HC_0H_0 \leq C_0H_0\dot{C}CH_0C_0H_0$

Since a) forms the most stable carbonation, it is most reactive

B5 a The order of reactivity depends upon the stability of processors formed by the elements of C. X bend. The 2' control formed from IV. The 2' curbons sen formed from IV was be more stable than 2 can be more from IV. The 2' curbons sen formed from IV. Was be more stable than the areatum ion formed from II. econose any particles are less reactive than askyl halides. However, It was be more reactive than I due to the processes of the electron withdrawing. We group which makes C. X bend weak and undergoes nucleophilic subsult. Set reactive fineses. Thus correct order is

- Bill c . If and 2" already balldes can be presented by reactions I ill and IV:

Ėг

- B14. (d)

 H₁C CH₂

 CH₃

 CH₃

 CH₄

 CH₃

 CH₄

 CH₃

 CH₄

 CH₅

 CH₅

 CH₆

 CH₇

 CH₇
- B16. c CH, CH, CH, Brue a primary halide. Therefore, it undergoes nucleophilic substitution in S_n2 mechanism. S_n2 reaction is festest in aprotic solventa (DMF).
- B17. If That is a higher of system in which orbito positions are iccurred by groups and both the rings are not in one plane. Therefore their inserts images are non-superimposable and the compound is option by seture.

B19. (c) :
$$CH_4$$
 Dr_2 $\Rightarrow CH_3Br$ N_0 $\Rightarrow CH_5CH_0$ (either $\Rightarrow CH_5CH_0$) (either $\Rightarrow CH_5CH_0$) (either $\Rightarrow CH_5CH_0$)

It is substitution reaction.

B91 b +
$$CH_3$$
CHCH $\cdot H_4$ $\cdot CH_2$, $\cdot H_4$ $\cdot CH_3$ $\cdot CH_3$ $\cdot CH_4$ $\cdot CH_5$ \cdot

- B94. (a) : The decreasing order of reactivity towards S₂2 reactions is CH₁CH₂CH₂CI > (CH₂CHCH₃CI > CH₂CH₂CHCICH₄ > (CH₃CICICH₄ CICICH₄ CICICH
- This is because of increasing steric hindrence.

 B25. .e . Tertainy alky: handes undergo b_u , reaction and the rate depends only on the concentration of alky! hadde

B27. (b) Aryl neitdes (C_aH_aCF donot undergo hydrolysis by S_{x+} mechanism under ordinary conductors CH_a CH_a CH_a

B28. c) CH_-CH_-C-OH_ = 1008 CH_-CH_ + CH_3CH_C-OH,

B7
1 Brome-3-metayibutano 2-Methyluut 3-me 2 Methyluut 1008

Might' Michie

B30. c • Neopentyl chloride does not have any β-bydrogen and hence it does not undergo dehydrohalogenation reaction

B31. (c The reaction follows S.L. mechanism so stronger the base die petter its mullerottmatic as

(c. The reaction follows S_p1 mechanism so stronger the base die netter its nucleoptimicity as CH₂O > OH > PhO > ArO:

B82, c . Analty, holides are more reactive than cryl helides and therefore, only the halogen in the side chain . e . The substituted.

B83. c Furnishing of carbocation is the rate determining step in S_g1 reaction. Therefore, the reactivity in S_g , reactions depends upon the stability of the intermediate carbocations. The a-ky-holide which gives more stable carbocation is more reactive awards S_g1 rescale.

If tavolves attarbocation Advikic carbacation 2° carbocation

Order of stability of carbocation is

Allyl > 3° > 2° > .*

Order of reactivity is B) > C) > A, Therefore, option (c) is correct

B34. (a) CH₂—CHCH₂CH₂ shows four isomers on menochlorination as

Manor earborating

The combounding is subsequently attacked both from top and bottom to give raceous mixture.

Rate of resolver descends on steen consulting of a levi hands. Therefore, the order of resolver as

B86. a Rate of reaction depends on starre crowding of anklythande. Therefore, the order of reactivity is OH₂Cl > CH₄CH₂Cl > (CH₄A₅CHCl > (CH₄A₅CCl)

The priority order at C-2 is The rotation is anticlockwise and bence its configuration is S.

H COOH

At C-8

The rotation is clockwise and hence its configuration is R

In this reaction, elimination occurs because 2-charge 2-methylponisme in a \mathbb{Z}^n -alky takide. It can mar undergressive embathous reaction as

Therefore all of these will be formed

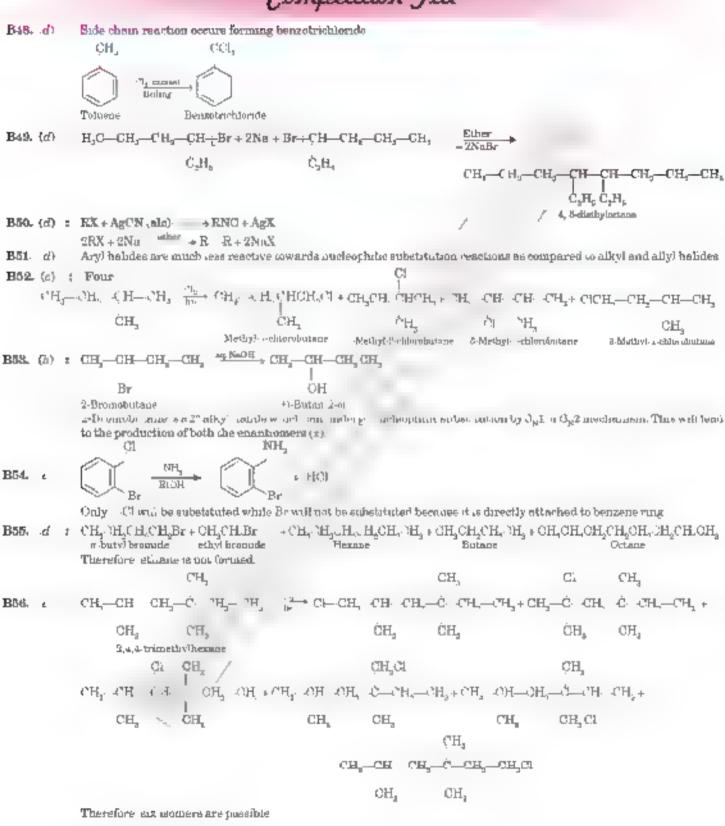
B41 b • In 5_a1 reactions the stability of carbocation formed determines the reactivity. French the stability of the carbocation, greater is the reactivity.

 $\label{eq:theorem of the property of the pro$

3-Mothylpent—equ.

Since the product contains 2-chiral centres, total number of stereousemers = $2^4 - 4$.

- B46. ε Arackyls are more reactive than anyl habdes and, therefore, only b and ε will react. Store precipitate has yellow colour it must be of AgI. Hence, option (ε) is correct.
- B46. α The audition of HBr to symmetrical alkanes. 2-butane is not affected by the presence or absence of perumda



B58. d : NO, group withdraws electrons from ortho and pure positions.

Boo. 6 . (1) 1, Foots (1) (1), Foots (1)

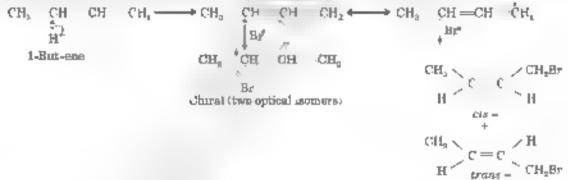
B61. b) Reactivity of alkyl bandes towards S_n2 reaction follows the order 1° > 2° > 3° Moreover better the enving group, higher is the reactivity. Br. an better leaving group theo Cl. Thus, oder of reactivity towards S_n2 reaction is

B82 .a) Alkyl asindes are polar in nature.

They do not form by dragge bonds, insoluble to water and indergo substitution reactions

Neopentyl bromide

- $\mathbf{B}\mathbf{0}\mathbf{0}, \ d'$: Chaprobenzene ary balide does not indergo nucleuph resubstitution reactions
- B87. (d) Allylic brommation with N-bromo succuminde proceeds through free retheat substitution.



Total 4 latimers

B68. (d) Since alky, brounds as nowe reactive diamarky, chloride, therefore, intramolecular Wortz reaction occurs on the side of British forming hisyelo product as



1-Bruno-3-cyclobotane

B69. (a) Alky! handes undergo audicophibe substitution more costly than anyl acades. Therefore, substitution occurs more easily than anyl acades. Therefore, substitution occurs more easily in the side chain, han in the ring. Further, since S_N2 reaction occurs with inversion of configuration, therefore, option is an energed and not option (b).



Inversion at 0-Br (8_2)

Rioyela menoperind

B7th (a) : The compound has two cheek central and hence is optically active

B71 b) The bulky groupe result into stars: hindrence in the formation of transition state. Therefore, was less reactive than P in the compound. S, the transition state is highly also builted by Ph-C, group and before it is most reactive. Hence, the

order of reactivity is S × P × R × Q

R78. (a): CH_a CH

The attack of H^* occurs in such a way that most stable (3° carbocation is formed.

Product Is in the major product, an accordance with beyonell rule, more substituted alkene is more stable

C. mcq with more than one answers

- C1 a b,d Except for trans-1 2-dichloroethens, all other compounds have dipole moment
- C3. v.c) CH, CH, CH, CH, CH, 2. CHI, + NaOOC CH, CH, COONA

 Herane-2,5-chios / Bodium americane

 O

CH, + CH, ')H, + 'Out of 's Mood of the A North A' CH, - CTs A's 4-setopostation and Indoferia

Compounds having $\mathrm{CH}_{3}\mathrm{C}$ — group give indeform test

$$CH_{\alpha}CH = \frac{CH_{\alpha}CH}{+SO_{\alpha}(H_{\alpha})} + \frac{CH_{\alpha}CH}{+SO_{\alpha}(H_{$$

C6.
$$\alpha,d$$
 . α C₀H₀ + CH₂CT $\xrightarrow{ACH_{b}}$ C₀H₂CH₃ + HC1 α CH₂TH₂Br + KCN \rightarrow CH₂CH₂CN + KBr atc

CB. (b.d)

C10. (a,b,d): (a I and II follow $S_n 2$ mechanism A^n balides.

- $b. Compound \, \text{Fe} \ \, benzyler \, \, and \, follows \, S_{\mu} 2 mechanism \, else \, and \, undergoes \, average of configuration$
- of The order is not correct.
- d' I is benzyl halide, and III is \mathfrak{T} alicyl halide and follow $\mathbb{S}_{q}1$ mechanism.

Integer Type Questions

- 1. 4 The compounds having chira, replan and therefore, showing ananthomers are: Butan-2-ol 2-Hydroxypropanoir acid 2-Chierobutane, 2-Browne-2-chierobutane.
- 2. (8, (at), (a)., otal
- 3. 5 (10), (111), (0), (011), 12.01.
- 4. 1 (c
- 5. 8) See Solvert Example 4, page 12
- 6. 5 d-Broton-5-cyclopentribezane has direct different types of a-bydrogen stome marked a n and a and hence give three short-turally sometic alkenes. Two of hase our exhibit geometrical sometimes and therefore, the total number of alkenes possible are five.

Total five optically active products I, III. IV VI and VIII are formed.

NCERT Exemplar Problems MCQs Type-I

- 1. 1b). Reactivity of alcohols towards beloged acids is 5" >
- 2. (d) 5° is most reactive

$$\mathbf{S},\quad \mathbf{e} = \begin{bmatrix} \mathbf{N}_{\mathbf{c}}^{\mathbf{H}} \mathbf{H}_{\mathbf{c}} & \mathbf{N}_{\mathbf{c}}^{\mathbf{H}} \mathbf{H}_{\mathbf{c}}^{\mathbf{H}} \\ & & \\ & \mathbf{N}_{\mathbf{c}}^{\mathbf{H}} \mathbf{H}_{\mathbf{c}}^{\mathbf{H}} \mathbf{H}_{\mathbf{c}}^{\mathbf{H}} \end{bmatrix} + \mathbf{N}.$$

- 7. (a) Density increases as molecular mass increases i.e. I < 15 < 111 < 17
- **8.** .c). Boding points increase as branching decreases i.e., III < I < II
- 9. (b) Carbon attached to four different atoms or groups is asymmetric
- (a). It is all ylur compound so which Er is attached next to double bonded carbon.
- 15. c). Markovukov's rule is followed
- .b). Primary olkyl balide would prefer to undergo S_p2
 reaction
- (a). Because carbocation will be readily formed.
- 18. (c) CH, CH, CH, Br 1-Bromo-2-methylbutana CH, CH,

19. (b). (C,H_)CHBr CH,CH,CH-Br 3-Bromopentana

- 20. d . Cl group at o. p.-directing group
- (a) CH₁O1 + NH₂ (excess) → CH₂NH₂ + RCI
- in. (a). CH₁'CHCH₁CH₂ having churst carbon.
- (a). C_aH_aĊH_a is stable carbocation and therefore, favoure S_a1 reaction
- 24. (b). (a and a carbon atoms are asymmetric.
- (a), only it because it proceeds through formation of carbocauca.

NCERT Exemplar Problems MCQs Type-II

- 89. (a). .e, CH,CHCL, CH,CL,
- 40. (a), (c) CH₂—ČH—Br CH₄ČH—CH₄CH, CH₄ Br CH₄CH₄CH, CH₄CH₄CH₄CH, CH₄CH₄CH₄CH,
- 43. (a), (a)
- 48. (b), c1 EC1+Hg,F/CoF, +RF



Tir	ne Anowed 2 Hrs. Maximum Mark	B 33
ı.	Which isomer of C,H,Cl with have the lowest boiling point?	(1
2.	Write the formula of the main product formed in the reaction	(1
	CH ₁₅ CHC Dry ather	
8.	How will you convert propene into allyl indide? Give equation.	(1)
	Why does indeform has appreciable antiseptic property?	(1
	How will you convert propens to propyne?	(1,
	Out of [sH,CH,C] and C,H, 'Ha'lC,H, which is more easily hydrolyted by aqueous k. H' Why!	12
7.	Which compound in each of the following pairs will react factor in S _q 2 reaction with PH? (4) CH_Rr or CH_I	.3
	gi) (CH _{ab} CCl or CH _a Cl	
H.	Write the IUPAC names of the following.	(3
	H CH	
	H CH CH CH C H,	
	H Y-Br	
	H	
ď.	Discuss the role of Lewis ands in the preparation of any monides and chromdes in the dark	12
	Why is the solubility of halosakanes in water very low?	(<u>51</u> ,
L III+	How will you distinguish between. a Ethyl chloride and ethyl bromide	(3
	Ethyl chlorida and sthyl bronide Chlorobenzene and cyclohexyl chloride	
	s) Vinyl chloride and ethyl chloride.	
12.	How do the products differ when ethyl brounds reset with KCN and AgCN? Give reasons	3
	How would you distinguish between S, and 5,2 mechanisms of substitution reactions? Two one example of each	9
	Bow will you convert	(8)
	a' Ethy) chloride to proponer and	
	 3) 1-Вголюджирале to 3-отоморгорале 	
	e tert-butyl bromide to seebutyl bromide	
iñ.	n. Gregourd rangent clinic due prepared under anhydrous conditions? Explain	9
	b) Cave two uses of aidofacto.	
	c) Write the structure and formula of D D T	
LG.	(a. Why are helorrence less reactive than haloritance? Explain	
	b Predict the allower that would be formed by dehydrahatogenation of the following handes with sodium ethoride in and predict the major alkene	etheoni
	2 9-7120ro-2-mothylbutano	
	12 S-bromo 2. 2, B-trumethylpentane	
	c) How is chlorobeazene prepared from beazenediazonian chloride?	(6)

► To check your performance see HINTS AND St LUTIONS TO SOME QUESTIONS at the end of Fart II of the book



ALCOHOLS, PHENOLS AND ETHERS

elichar dantella e.

But ding on....

- Unnerstanding Text
- Conceptual Questions 50.78

CHAPTER SUMMARY & QUICK CHAPTER ROUND UP

NO ERT PILE

- In-text 4s & Exercises with Solutions
- NCERT Exemptar Problems with Answers & Solutions Subjective) 98

Assossing. L

- Quick Monory Ten with Answers
- HOTS & Advanced Level Questions with Answers

78 REVISION EXERCINES

with Previous Years (BSF we & Other State Boards Qu

 Hinta & Answers for Revusion Exemples

UNIT PRACTICE TEST

Preparing for Competition

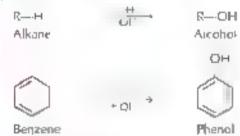
· Andibonal	سألعدل	Information	1.2
 Tonrewise 	MCO ₀		113

- Competitive Examination Qs
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 - NCERT Exempler Problems
 (Objective Questions) 181

Acousts are his compounds that have one or more hydroxys. OH groups bunded to atiphatic carbon atoms while phenois are the compounds which have one or more. OH groups bonded to the aryl carbon atoms (aromatic rings), These are obtained by replacing one or more hydrogen atoms of allohatic or aromatic hydrocarbons by hydroxyl (-OH) group.

99

The compounds obtained by replacing one hydrogen atom from aliphatic hydrocarbons by hydroxyl group an atomolic whereas those obtained by replacing hydrogen atom of aromatic hydrocarbons are phenole.



Alcohols have many important app cations in day-to-day life. For example, ethanol (C₂H₅O)+1, simply colled alcohol is wridely used as an important component of at a coholic beverages, as a solven) for

mail medicines acquert and carriches it is also used if the own of reclined spirit or policing wooder and relative and as an analysistic Phanois are also sed for the manufacture of dives reside balloce etc. In act alcohols are very popularly used for the synthesis of other classes of argunic compounds such as alkahes, initializations, added to the synthesis of other classes of argunic compounds such as alkahes, initializations, added to the synthesis of other classes of argunic compounds such as alkahes, initializations.

The soust rotter of a hydrogen atom in a hydrocurbon by an alkoxy IRO) or arvious group .ArO, gives another class or compounds known as **ethers**. These are also an important class or compounds. For example, diethy, ether has been extensively used as an industrial solvent.

PART A

ALCOHOLS AND PHENOLS

CLASSIFICATION OF ALCOHOLS AND PHENOLS

Alcohols are the compounds route a ng hydroxy, group. OH attached to the mikel group. Therefore, these are tegarded as hydroxy demonstrates of hydroxyrbons and are also called allohatte alcohols. For example,

 CH_{3} $\cdot H$

 $CH_3CH_2 > H$

ен,си си,он

Methyl aicohol

Ethyl alcohol

Propyl alcohor

The alcohola are represented by the general formula ROH

The Ecohols are further classified as monohydric deledes, rehydric in polyhydric alcohols depending apol, metwo, three in more hydroxyl groups present in their molecules. For example

снасылон

СН₂ОН СН₂ОН CH₂OH CHOH CH,

Estyl alcoholi Mazobydese

Giyeo) Dreydeid

CH_nOH Glycerol (Trultydruc) . /

Alditol (Polyhydric)

If may be noted that more than one OH groups cannot be present to the stone carbon atom. In such a case, he compound at I be extremely unstable and and readity case a water unlecture to form more stable aidehyde, ketone or carboxylia acid.

CH_a C—O H

H₂¢

CH_a C=O

Similarly if three OH groups are present on the same carbon show, the molecule loses a molecule of water to form earthreylic need.

ой в с он

OH

zigli, 4

O fl R C OH Carbosylle acid

Phenols are hydroxyl derivatives of aromatic hydrocarbons in which the hydroxyl group. OH is directly attached to the carbon atom of the aromatic ring.

For example.

OH

Phenol

OR 3BL

2-Bromophenoi o-Bromophenol OH CH

2-Mothy-phenor or o-Methy-phenol or o-Crespl OH 1 CH₃

3-Methy-phenol or m-Methylphenol or m-Crosol OH CH,

4-Methylphenal p-Methylphenal or a-Cresor

Like alcohols, phenols may also be classified as mononydric drhydric, trihydric or potyhydric according as their molecules contain one. Intr.—Area or turne hydroxyl groups respectively. These compressed are popularly known by their common names. For example,

ОН

Phesol Monohydrae ОН

1 2-Benzenediol (Catechol Dihydro OH OH

1 3-Benzenodad Repareino), (Dihydrio) OH OH OH

OH
1 4 Benzenediol
Hydroquinone or quinol
(Duhydric)

OH IS OH OH

1 2 4-Henzenetriol (Hydroxyquinol (Trihydric) OH 3 OH 1, 2,3-Benzenetzal

2,3-Benzenetzu Pyroga (ol. (Trohydric Dihydruny derivatives of benzene are known as 1,2-, 1.3- and 1,4-benzenediol

Aromatic alcohola

It may be noted that I the hydroxy group (OH is not directly linked with benzene ring and is present in the alky) side chain, then the compound is not a phenol. It is called **aromatic alcohol** because it resembles alphabe alcohols in its characteristics. Thus, the **aromatic alcohols** are those in which the hydroxyl group is present in the side chain of an aromatic hydroxorbon

For example,

Classification of alcohols

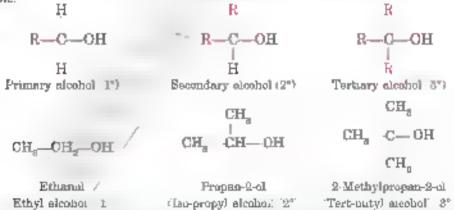
Monohydric alcohols may be classified on the basis of hybridization of the carbon atom to which the hydroxyl group , OH) is attached.

Compounds containing C_m¹ —OH bond

In this type of a cohols, the hydroxyl group to Hills attached to an springbridged carbon atom of an alkyl group. They are further classified as follows

or. Primary, secondary and tertiary alcohols. The a cohels are classified as primary secondary and arthory alcohols depending upon the hydroxy group attached to a primary secondary or a tertiary carbon atom

- 1 Primary alcohols 1°) which have one or none a kyl group on the carbon bonded to OH group.
- its Secondary alcohols (2) which we whow why groups on the curbon bonded to. OH group.
- (iii) Tertiary alcohols 8*) which have home a hyl groups on the carbon bonded to OH group. For exemple,

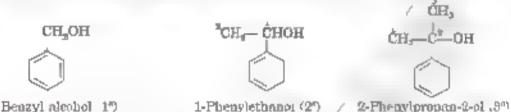


Thus, it is clear from the above structures that the characteristic functional groups of primary secondary and tertiary sleohols are.

CHOOH	≥сн—он	>с—он
Primary (1°)	Secondary '2")	Terhary 3°1

(b) Allylic alcohols. In these arolads, the hydroxyl group is attached to a sp³ hybridised carbon next to a carbon-carbon double wind known as allylic carbon. These aironols can also be classified as primary secondary or certary allylic alcohols. For example,

(c) Benzylse alcohols. In these alcohols, the hydroxyl group—OH—is attached to a sp³ hybridised carbon atom next to an aromatic ring. These archivis may also be classified as 1° 2° and 8° beazylic alcohols.



These are also called aromatic alcohols.

2. Compounds containing Una -OH bond

In this type of alcohola, the hydroxyl group : OH is ottached to a lorbin carbon double bond.

These are of two types

(or Varylic alcohols. These contain. OH group at sched to a carbon atom of a carbon-carbon double bond. These alcohols are called vinyl alcohols. For example,

(b) Phenois. These contain OH group attached to be a choraton of benzene ring. For example,

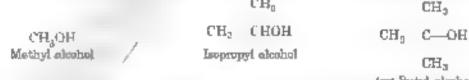
Hydrogamone or Quinol

NOMEN, LAPURE

Nomenclature of Alcohols

(a) Manchydric alcohols.

tri Common names. According to common system of nomenclature, alcohols are named as allevi alcohols in which the adept group attached to the - 4. It group is named and the word alcohol is added to it. For example,



terr-Butyl alcohol

(ii Carbinol system, in this system the simplest monohydric alcohol. $H_0 \cup H$ is called carbinol while other alcohols are named as alky-derivatives of carbinol. For example,

	ÓН	ÇH _a	ĊH ^a
CHaCH', H	CH^3 CH CH^3	$C_2H_2 \stackrel{\circ}{\sim} H+OH$	CH ₂ C CH ₂
			ÓH
Methylcarthiol	Jimatarylenthing	24(ybbetliylombuso)	Phoethylendoso

(##) RPAC system. According to IUPAC nomenclature, assoliols are named by replacing 'e' in the name of parent askane by 'ol

Alkane $\sigma + \sigma l = Alkanol$

In this system, the following rules are followed.

The ongest communications chain containing the carbon bonded to CH group is selected as the parent chain

- The carbon atoms in the chain are nombered in such a way that the carbon atom carrying the hydroxyl group. OH gets the lowest number.
- The position of the substituents is indicated by suitable numbers.

The common and IUPAC names of a few monohydric a cobrist are given below

Formula	Савмев ваме	IUPAC name
CH, 6H	Methy- acobol	Metuanni
H _{sc} H c H	Ethyl akohol	Ethanoi
CH ₂	n-Prupy- alcohor	Propan 1 of
H ₃ CHcH ₃	Isopropymecohol	Propan-2-ol
OH		
CH _B CHCH ₂ CH ₅	sec-Butyl simbol	Butan-2-ol
OH		Martin Control
CH,CH,CH,OH	z-Butyl alcohol	/ Butan-1-ol
ти,сиси,он	Isobuty' alcohor	2-Methylpropen-1-or
CH ₁		
CH ₂		
CH _b · € -OH	terr-Butyl areasol	2-Methyl.propra: 2-or
ĊH,		
-		
CH ₀ CH ₂ CH ₂ CH ₂ CH ₂ OH	a Amyl siculot	Pentan 1 of
4 3 2 1		
CH _a CH CH ₂ CH ₂ Ob	Isoamy, azentañ	8 Mechylbutan 1 ol
ĆНа		· ·
- aag		

THE ILPA, names of a lew other substituted alcohologice given below СИ₃СИ₂ С СИ₂СИ₃ $CH_3 - CH - CH = CH_2$ CH_a CH CH_aOH 2 Меснуірноров д ня $CH_2CH_2CH_3$ But 3-en-2-ut 3-Ethylhestan-3-ol OE ch, ch, ch, ch, ĆH₃ $\dot{\mathbf{C}}_{\mathbf{g}}\mathbf{H}_{\mathbf{g}}$ 3-Phenylpentan-3-ut S-Methylbutan-Z-ol ĊR, OR CH_a CH_a Butane 1, 3-diol 4-Methylpen an oil 2,2,3 Termethy persons and ~ OH Prop-2-ytt-1-0) 3-Methylpent-5-on-9-ol Prop-2-en-4-01 Hex-4-en-2-ol Cyclic alcohols are named by using the prefix cycle and considering the—OH group attached to C-1. For example, CH,CH,OH trans-3-(2-hydroxyethyl-Cyclobutanol -yelohexanoi 2-Methyleyelopentanol Cyclopentagor

b) Polyhydric alcohols. These contain two or more—OH groups to their noiscules. The dehydric elcohols (containing two—OH groups, are called glycols. These are defined as α, β, γ——α glycols depending upon the restance positions of the two hydroxyl groups. For example, α-glycol is 1.2-glycol. β glycol. 8.1.3 and α-glycol. This two OH groups attached to be terminal prince, atoms, in common system, α-glycols are named by author, he work glycol to the name of the aikene from which they can be obtained by direct hydroxylation. For example

Propytene glynnl.

On the other hand, $\beta \gamma = \omega$ accords are assued as the corresponding polymological givens. For example,

HO-CHICHICH, OH

HO CHARLET H. OH

Calm Cl aOrl

Propage L. S-diol

Trimethylene glyrol

Pantamethylene given)

β-gtycut

m-gt cul

The tribycare aconous do not have any general rules for naming. The cour ion example is

 $CH_{2}OH_{1}$

CHOH

Glycarul or glycerine

ĊH₂OH.

In Π PAC system, polyhydric alcohole are easily named as $d_{10.5}$, $d_{10.5} = ex$, indicating the position of hydroxyless. groups. For example,

он сн. сн. он Ethane . 2-diol

OH OH

CH OH

Propene-1 S-diol

Propone-1 2, 3-tmc1

Numericlature of Phenois

According to common system of nomenclature, the larest member of the family is phenol. The other members are named as denealines of phenol. The position of the substances is indicated by the prefixes of the local for a 2: meta m. for L. 9 a: 1 paro p. for 1. 4. However, some substituted phends are stdl. popularly known by their trivia names. For example

OH

o-Mothyl phanal (a-Cresol)

m-Methy, phanol tra-Cresol.

p-Methyl phenol (p-Creso)

OH

o-Dihydroxybenzeno Cauechou

According to IUPAC system size, all are substituted phenois are named as derivatives of phenois. The position of the substituents wirt >H group is indicated by Arobic numerals with the carbon carrying. OH group being numbered 1), For example,

2-Methylphenot .a-Cresol

a-Mathylphenul m-C-resor

CH2

4-Mothylphonol p-Greed)

2.4. 6-Trinitröphenel (Pieric acid)

2-Bromophedia e-Brompehengt

REMEMBER

2. 4. 6-Tria trophene is popularly known as pierie nerd.

OH4-Nitrophenol (p-Nitrophenol)

OH 3-Aminophenol m-Ammophenot

Alcohols and ethers are

funorional reomers.

In RIPAC system, do to or popyl ydrac phenola are named as hydroxy ferivatives of penzene. However, they are popularly known by their common names. For example,

It may be noted that certain groups such as carbonyl aldehydic betonic or scidic or scyl group esters take preference wer file phenone. OH group in letermining the parent in te. In these cases, the intenon group is named as hydroxy and is treated as a substituent,

or nalicylnidebyda) ISOMERISM IN ALCOHOLS

For example.

Alcohols exhibit four types of structural isomers

Chain isomers. Alcohols containing four or more carbon atoms exhibit chain isomerism in which the isomers differ in the chair of carbor atoms attached to the hydroxyl group. For example,

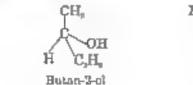


 Position isomerism. The accided containing three or more carbon atoms exhibit position isomerism in which the isomers differ in his position of hydraxy, group. For example,

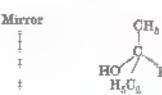
7 Functional isomerism. Monohydra skeehols containing two or more carbon atoms exhibit functions. somerism at which the somers differ in the functional group. For example,

CH₀CH CH $CH_a \cup H_a$ Methoxy methans

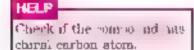
at Optical teamerism. Manufaydric aboutots constiting chiral carbon assumexhibit optical isomerism.



Ethenol



Other monohydric dicohols showing optical isomerism are



SOLVED EXAMPLES

J Example La

Drow he structures of all someon archives of movement formula $C_sH_m\Omega$ and g_t within It PAC names. Classify them as primary, secondary and tertiary atrohols.

	m as primary, secondary and u tim: The isometre a cohois				
	CH,CH,CH,CH,CH,OH		4		Prunery
T.	CHacking Care H ₂ OH			2-Methyllostan ital	Promary
	€ li _{*B}				
	си, сиси,си,он			8-Methyllrutan-1-til	Prunary
	CH _a			,	
	CH _B				
w)	CH _B O CH ₄ OH		- 6	2. 2-Dimethylpropan-1-al	Primary
	OM _B				
b	CH _a CH _p CH _p CHCH ₂			Pentan-2-ol	Secondary
	ОH		1		
ÇI,	CH4CH2CHCH2CH3	,	,	Penten-3-ol	Secondary
	OH				
20	CH, CH CHCH,			3-Methylbutan-2-ol	Secondary
	CH DH				

☐ Example 2...

Name the following compounds occording to IUPAC system



ig
$$CH_3$$
 $C = C$ CH_4OH (A.I.S.B. 9017

$$if \quad H_{\beta}C = CH \quad CH \quad CH_{\beta} \quad CH_{\beta} \quad CH_{\beta} \quad CH_{\beta} \quad \text{N.C.E.R.T}$$

A.I.S.B. 2017)

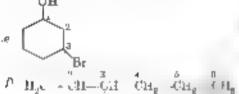
$$CH_3$$
 Bc
 CH_3
 CH_3
 CH_3
 CH_4
 CH_5
 CH

Ċ,H,OH

The functional group -OH geta lowest number

Solution:

$$q_{1} = \frac{c_{1}}{c_{2}} + \frac{c_{2}}{c_{1}} + \frac{c_{1}}{c_{2}} + \frac{c_{2}}{c_{2}} + \frac{$$



$$e^{-\frac{1}{2}}$$
 $e^{-\frac{1}{2}}$ $e^{$

4-Chloro-2 3-done/bylpenian real

2, 6-Dimethylphenol

3-Chioromethyl-1-isopropylpentan-1-ol

2. 5-Dimethylheran-1, 2-diol

Bermocyclohexano).

Her read-of

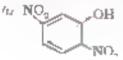
2-Brono-3-methylbut-2-en-1-or

6-Phenylprop-2-en-1-ol

8, 3-Danethylpentan-2-of

Write the R PAC name of the following compounds.

D.S.B 2016



tu, HO CH, CH CH, OH

A.18.B. 2018

 CH_n

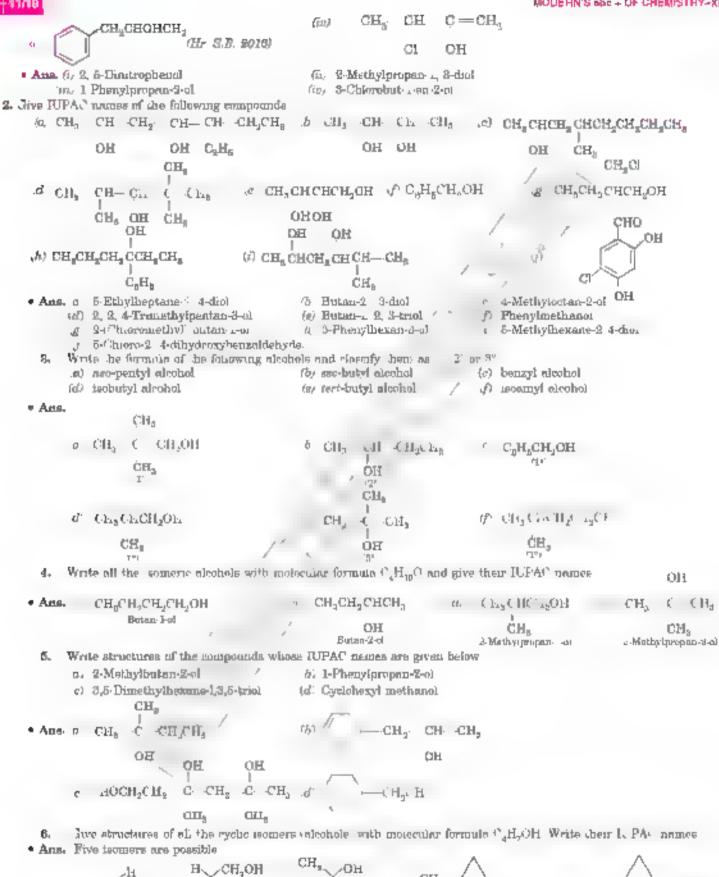
OH

Cyclobulano

OH

CH,

Trans 2-Mathyleyetuproponul

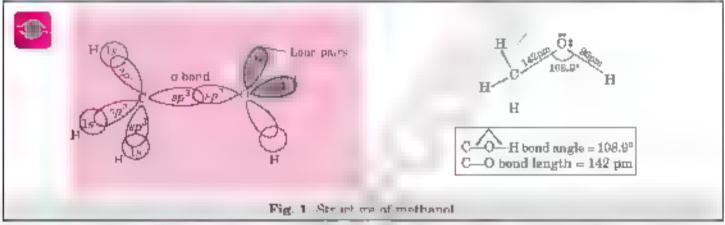


Cyclopropylmethanul 1-Methylcyclopropanol Cu-2-Methylcyclopropanol

7 Write the RPAC names and draw structures of the following compounds whose common names are given.

STRUCTURE OF COMPOUNDS CONTAINING -OH GROUP

In alcohols, the oxygen of OH group is conded to the sp^a tylendised carbon by a signia band. This bond is formed by the overlap of sp^a tylend or stall of carbon with one sp^a hybrid orbita, of oxygen. The remaining three sp^a tylend orbita is of carbon overlap with 1s orbitals of hydrogen. In the case of oxygen, one sp^a tylend orbital overlaps with 1s orbitals orbitals routed lone pairs of electrons as shown below for methanol



The bond angle —O—H in methanoi is slightly less than the tetrahedral angle (109° 28'). This is due to larger repulsions between the lone pairs of oxygen.

In contrast to methanol, the -OH group in phenols is attached to sp^3 hybridised carbon of an aromatic ring. The bond angle C+O+H in phenol is 100° . The 1-C bond ength 136 pm in phenol is sughtly less that that in methanol. This is due to partial double to make the aromatic of C+O bond because of the conjugation of lone pair of electrons of oxygen with the aromatic ring.

Bond angle C
$$\bigcirc$$
O H = 100°
Bond length C \bigcirc O = 190 pm

It may be noted that since the hygen atom is more electronegative than noth carbon and hydrogen, the electrons of $C \rightarrow C$ and $C \rightarrow C$ bonds are more magnituded towards the C atom. As a result, the electron density near the C atom is slightly more than that hear cost on and hydrogen atoms. Consequently an alcohol molecule is dipolar in nature with oxygen corrying a partial negative charge to—and random and hydrogen each carrying a partial positive charge. Set C is supported by the fact that alcohols have high dipole moments. For example, methenol has a dipole moment of 1.71 D.

$$H_{\bullet}C = O = H$$
 $\mu = 1.71 D$

Plane so the other hard has a moder dook removed 154 P. then a sthe of The is disc to the reason that C—O hard a phenol is test potar due to exciron in horizoning effect of the wazene ring. On the other rand, C—O was at methans, a more polar due to electron doubting effect of the CH₂ group.

Die et aprier neuere electrons and phenois form intermitier car hybrogen bonds.

METHODS OF PREPARATION OF ALCOHOLS

The unportant methods of preparation of alcohols are:

1 Preparation from halonlanes.

Haroallimies, when boiled with aqueous NaOH or KOH or moist silver oxide. AgOH: give alcohols

Primary hatoa kanes give good yield of atcohots. However, terhary haloa/kanes, n=n s reaction give metricy a kenes due to dehydroharogenation. Secondary haloakanes give a missure of accohor and a sens

2. By reduction of aldehydes and ketones.

Alcohols are easily prepared by the reduction of aidehydes and ketones.

The reduction is carried out by common reducing agents such as — hydrogen in the presence of a catalyst scattly is hydrogenation, such as finely divided placinum, palendown inches and ratherium in sodium in the presence of ethy is robot to — high im attaining an hydrote lathous sets by moontainingsto III., LiA.H., or somitin reconsidered (sodium tetrahydridoborate tII), NaBH₄.

During reduction, aldehydes gives primary alcohol- while ketones give secondary alcohols. For example,

Tertiary alcohols cannot be obtained by reduction of carbonyl compounds.

Reduction of carbonyl compound involves the addition of hydride ion (H = reducing the carbonyl group to alknowle ion which on protonation gives the alcohol.

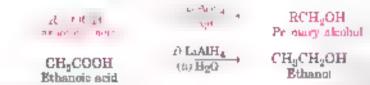
The complex hydrides—LiAiH₄ and NaBH₄ also reduce carbonyl compounds in excellent yields. They also reduce the carbonyl compounds in a stepwise themser, each step involving a hydride ion transfer as

Sodium borohydride (Na* BH_s) also reacts in a similar manner.

It may be noted that LAH, reacts **violently with water** and therefore, the reaction with LAH, most be carried out in antividuous conditions generally in antividuous either. Jenaily ethyl accions as added cautiously after the reaction is over as decompose excess LaAH, and then water is added to decompose animalian complex.

a. By reduction of carboxylic neids and esters

Carburyke acids are reduced to primary a)cohols in the presence of strong reducing agent, athium animum withde.



Esters are men removed to alreads and give a marture of two alreads, one from the acy group RCO— and the other from the ackary (—OR) group.

Reduction of sidehydes, ketones and esters with sodiani and alcohol is commonly known as **Houvenult Blane** reduction

Note. It may be noted that reduction of carbon be not is by LaAiH, gives excellent yield of alcohols. However, LaAiH, he ag an expensive reagent, is used only for preparing special chemicals. Therefore, renumerously ands are reduced to alcohols by first converting in the three extensions of the presence of a late, yet catalysic hydrogen contacted hydrogenolysis) and the socialist and alcohols.

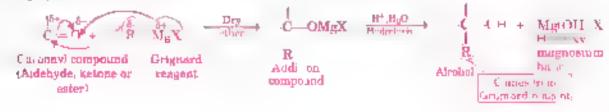
4. From Grignard's reagent

(a) By reaction with aldehydes, ketones and esters

Originard's reagent RMgX are alkylor aryl magnesium habites. The C+ Mg bond in Grignard's reagent R+ Mg $^{-}$ is lighly point recause curbon a electronegative electronegative ty=2.5 relative to electronegative magnesium electronegativity = 1.2. Due to the polar nature of C+Mg bond ariginard's reagents are very versable reagents in original synthesis. Grig- and a reagent RMgX reacts with a dehy less ketones and esters to form addition products which decompose with Sil. HCl or dil. H₂SO₂ to give alcohols.

The reaction mechanism involves the simultaneous attack of the nucleophile alkyl carbanion R) of the Grignard tengent to the carboxyl carbon atom and the remaining north a gets accorded to the expgental and of carbonyl group forming addition product. This is then decomposed by water to give alcohol.

For manmple,



Different types of alrehols are obtained by this reaction

(1) Formaldehyde gives primary alcahol

(ii All aidehydes (other than formaldehyde) give secondary alcahols

(iii) Kefones give tertiary alcohols

(iv) Esters give secondary and tertiary alcohols

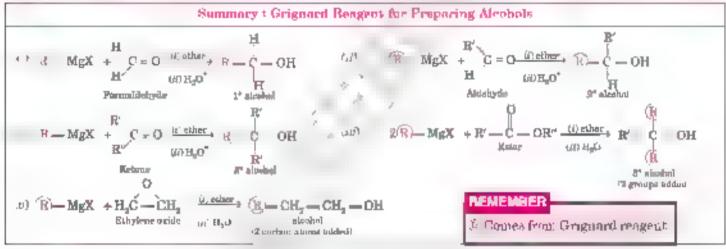
Esters can also be converted into alcohole by treating with statable tangeard reagent. Secondary alcohole can be prepared by the addition of statable tangeard reagent to esters of formic and followed by and hydrolysis. For each size,

Tertiary alcohols containing at cost two identical groups can be easily prepared by the addition of Grignard reagent to an ester other thin former ester followed by and by drokysis. For example,

(b) By reaction with ethylene oxide or oxirane

Epoxyalkanes such as extranes or ethylene exide react with Gright rd reagent in the presence of anilydrous ether to form addition products which are hydrolysed by water in the presence of and to form atcohols. For example

This is an excellent method for conversing as a kyl he idenation of primary alcohol containing two carbon atoms more than the alkyl halide. The alkyl halide is first converted, no the corresponding triggnard reagent by reacting with Mg in dry ether followed by reaction with ethylene code and subsequent hydrolysis.



5. By hydrolysis of esters. Alcohole are generally prepared by hydrolysis of esters with aqueous alkalies.

From alkenes.

Alkenes can be converted into alcohols by the following methods

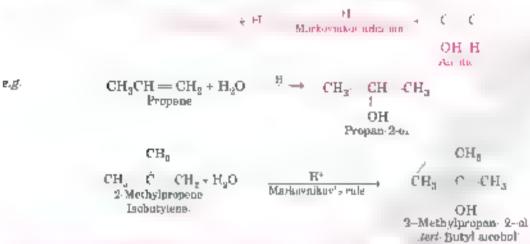
(a) By acid catalysed hydration of alkenes

The hydration of alkenes can be carried out directly or indirectly

In the indirect process, sixenes are passed through conc $H_3S\cup_4$ to form alkyl hydrogen sulphates, which spon hydrolysis with boiling water give alcohols.

In case of unsymmetrical alkeries, the add not of H. SO, takes place in accordance with Markovarkov's rule to hydrogen goes to that carbon at an which contains large number of hydrogen at ins.

Reactive alkenes directly add a molecule of water in the presence of mineral acids as cotalyst to fortule cohor



Many printer: Hydration of alkenes

The mechanism of the reaction involves the following steps:

Step 1. Alkelie gets protonated to form a corbonation \rightarrow . electroplains attack of H_3 \rightarrow H_4O+H^+ \rightarrow H_5O^+

Hydronium fon

H

C

C

+ H

Q

H

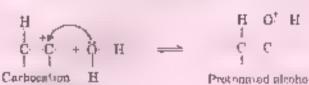
C

C

+ H,07

Carbocation

Step 2. Nucleophile (H... attacks the carboca ion forming protonated alcohol



Step 5. Loss of H* from mygen (depretonation) to form alcohol.

HOTE

It may be noted that during step 1, addstand of a proton occurs on that carbon atom of the double bond which gives a more stable carbocation.

th Hydroboration oxidation reduction. Alkenes react with dibarance B_nH_n , o form trially borance which approximate treatment with alkaline $H \supset give$ arcobols. This reaction involves the addition of water to a double bond approximate that of Markovnikov's rule. This now was two reactions, addition of borance BH_n to double bond called hydroboration exidation and hydrobysis to give an alcohol.

Diborance is an electron deficient molecule. Therefore, it acts as an electrophile reacting with altene to form alkyl borance R_sB as

In each addition step, the boron atom is attached to carbon atom of the double bond that is bonded to larger number of hydrogen atoms. The hydrogen atom is transferred from boron otom to the other carbon atom of the double bond. Thus, the addition occurs according to anti-Markovnikov's rule. During andation of traskyl borone, boron is replaced by -OH group. The yield of alcohol is excellent and the product can be easily isolated.

(c) Oxymerouration-demorcuration reaction

Alkenes reset with mercuric scetate $\sim H_{g}(-O)$, $\sim Hg$ or Hg OAcg in the presence of water to form oxymercurs and octs which upon restaction with NaBH, in a kname steel an give archote.

Alkenes react with mercuric accuste in a mixture of tetrahydrofuran. THF and water to give hydroxyalkyl mercury compound involving adultion of CH is dill Hgf Acts the louble and This also red oxymercurition. In the second step, sodi an iorohydride reduces. Hg iAs and replaces it with hydrogen. This is called demonstration.

The net reaction involves addstrate if H and OH is accordance with Markovin key's rule

This reaction is very fast and produces the alcohol in high yield. The ancohol obtained corresponds to Markovnikov's addition of water to alkene

REMEMBER

Alkenes can be converted to alcohols

And catalyzed hydration proceeds arrunding to Markovnikov rule

$$RCH = CH_2 + H_2O \xrightarrow{R} \rightarrow E + CH + CH_2$$

Hydroboration condition reduction proceeds according to an i-Markovinkov rule

$$RCH = CH_1$$
 $\frac{1}{2} \frac{Bh_3}{Bg} \frac{THF}{Gh} \rightarrow R$ CH CH_2

Oxymerogration-democramition proceeds according to Murko viriles rule.

$$\mathbf{RCH} = \mathbf{CH}_2 \xrightarrow{\mathbf{H}_{\mathbf{C}} \cup \mathbf{Ac}_{\mathbf{D}}} \mathbf{RCH} \xrightarrow{\mathbf{CH}_2} \mathbf{RCH} \xrightarrow{\mathbf{CH}_2} \overset{\mathbf{CH}_2}{\downarrow}$$

Hydration of alkene occurs through carbocations intermediates. Since carbocations have a tendency to undergo
rearrangement to form stable carbocations by 1. 2 hydride suffor 1.2 ment y staft, the products are retrianged
alcohols.

Hydrohoro for availation or asymmetrized named whose anot available corbonet in attended size and hence a mayor form expected (unrearranged) alphole.

8. From aliphatic primary ammes

Primary annues react with introde are i N, No₂ \star HCl to form i cohols along with the evolution of introgen gas

METHODS OF PREPARATION OF PRENOLS

Phenoms a so called **earbolic** acid. It was first isolated in the early 19th century from coal tar. Nowadays, phenoms manufactured synthetically. Lit he laboratory, phenoms are prepared from renzene Jerivatives by the following methods:

1. From benzene sulphonic soud. Benzene is sulphonated with occum (mixture of H.St., and St., e. H.S.O., and benzene sulphonic soud so formed is converted to sodium phenoxide by heating with molter, sodium hydroxide. This on scidification gives phenot.

ALCOHOLS, PHENOLS AND ETHERS



2. From diazonium salts. An aqueous solution of beazene thazonium end on warming gives phenol-

Beczene diazon am of londe required for the reaction is obtained by treating and ne with natrous and NaNO, + HCl is low emperature 278-378 K 6-5°C. This rescans is called diazotism ion resolion.

 By decarboxylation of sodium salt of salicylic acid. Phonor can be prepared by fusing somum sameylate with soda time. Nat. H and CaO mixture. followed by acidication with di. HCl.

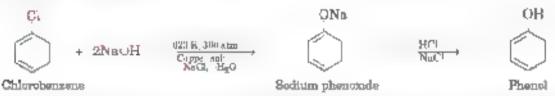
OH COONs
$$+$$
 NaOH $\frac{C_0O_1 \cdot \theta_{est}}{-N_{a2}CO_2}$ Sodium phenoxide $\frac{H^{C_1}}{N_{a}C^2}$ Phenot

4. From Grignard reagent. When oxygen gas is bibbled through an ethereal solution of pheric magnesiani bromide august reagent. It forms an oxy compound which apon hydrolysis with dilate mineral acid gives phenol.

Commercial Preparation of Phenols

On a large scale, phenol is obtained by the following methods

1. From chlorobenzene Dow's process). Phenol is manufactured by heating chlorobenzene with 10% aqueous sodium rydroxide and tion or mount 623 K under 800 minospheres and 4, the presence of copper so t acting as catalyst to form sodium phenomes. The sodium salt when treated with diame Hall, gives phenol. This method is called Dow's process.

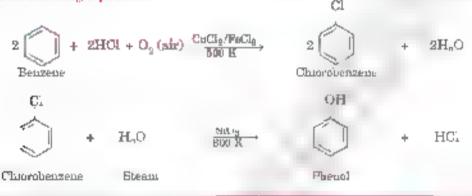


2. From sumons. Phenol is prepared commercially from cumene isopropyl benzene). Sumone is prepared by Friedel Staff sikylation of benzene with propene in the presence of phosphoric and at 523 K.

T' a result on as Freedel Braits autylation reaction.

Cumene is ondised in the presence of air in camene hydroperoxide which upon subsequent hydrolysis with dil H_nSO_a gives phenol and propanous (acetone).

8. From benzene (Ruschig's method). Vapours of hydrochiene and are passed over benzene at 500 K in the presence of copper. He channel catalyst and ferric of loride catalyst and excess of air to form of probenzene. Steam is then passed, brough chlorobenzene at 800 K in the presence of air to as a adject to give phenol. This method is known as Ruschig's process.



- WOLFER D'OXENNE S

□ Example 8...

since the structures and HPAC names of products expected from the following reactions

- ta. Cutalytic reduction of butanal
- (b) Hydration of propens in the presence of datate susphure acid.
- ic Reachan of proponone with methy, magnesium bromide followed by hydrolysis

N.C E.R.T.

Som our

J Examp : 4

Use a Grignard's reagent to prepare the following alcohole

(a) 2-Phenylbutan-2-ol

%: 3-Methylpenton-8-or

(c) 2 Methylpentan-2-al.

(d) 2-Phenylpropan-2-ol

(e) 3-Methyl I phenylbutan I-ac.

PHYSICAL PROPERTIES OF ALCOHOLS

The important physical properties of alcohola are

(i) Physical state. At ordinary temperature—he lower members are colouriess aquids having a characteristic smell and running taste. The higher members—lawing more than 12 carbon atoms, are colouriess, odouriess, wax ake souds.

.6) Boiling points. The boiling points of alreads are much higher than the corresponding alighatic hydrocarbons and haloalkanes. For example,

Compound	CH,	CH3C	CH3B4	CH_OH
Boding point	90 K	/ 249 K	278 K	997.6 K

The astronger there is taged flerence of electronegativities of oxygen and hydrogen atoms. As a result, the C—H band is strongly polar and furms hydrogen bands in alcohols, these exist as associated molecules mather than discrete molecules as shown below

Therefore, a large amount of energy is needed to break these extensive hydrogen bonds and hence their boding points are high.

It may be noted that alcohols have generally higher boiling points as compared to their isomeric ethers of same molecular messes. For example, the bosong point of ethyl alcohol, more mass = 40, denethyl ether that mass = 40, and propage (mol. mass = 44) are

Ethyl alcohol	Dunethyl ether	Propane
951 K.	248 K	231 K

This is due to the presence of intermotecular hydrogen bonds in atcohols and their absence in ethers and hydrocarbons.

Aucohols form hydrogen

The lower members have low boding points but with the increase in number of carbon atoms (molecular mass), the boding points keep on increasing gradually. This is because of increase in van der Wishis forces. For isomeric alcohols brying the same number of carbon atoms, the boding points are in the order.

primary > secondary > tertiary.

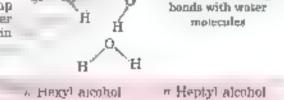
Compound	ĊĦ [®] ĊĦ°ĊĦ°ĊĦ°ĊĦ	гн _{ак} ененьов	CH3CH4CH OH4CH3	CH35COH
	Button-1-0a 1 "	2-Meti, ylpropan-1-ol 1	Butan 2-or (2**	2-Methy propan 2-of 30
Boding point	39. K	381 K	373 K	386 K

Thus is due to the fact that with branching. The surface area decreases and therefore win der Waars forces decrease. Consequently, boiling point also decreases.

water but the solubility The lower members of alcohols are highly soluble in water but the solubility decreases with increase in molecular weight. The solubility of tower alcohols in water is due to the formation of hydrogen bonds between alcohols and water molecules.

However, as the size of alcohol molecule increases, the alkyl group becomes larger and prevents are formation of hydrogen bonds with water molecules and hence the solubility goes on decreasing with increase in eight of carbon chain or molecular mass of alcohol.

For example.



Alcohol	a Putyl alcohol	a Pentyl alcohol	 Heigh alcohol 	n Heptyl alcohol
Solubility (in g/100g H _o O)	7.9	2,3	0.65	0.2
B B				

However, our night isometric alcohols, the scribbity increases with branching. This is the to the reason that as the branching increases, the surface area of non-polar hydrocarbon part decreases and the solubility increases.

Alcohol Solubility	n-Butyl areanol	leobi tyl ali iliot	Ser-butyl a robe	tert Butyl alcohol
in g/100g H _a c	79	0.0	12.5	very large

(iv) Density Generally alcohols are lighter than water a though the density increases with increase in moterniar mass

(r) Intoxicuting effects. Accords have inconcating effects. Methanol is poseonous and is not good for drinking purposes. It may cause bandness and even death. Ethanol is used for drinking purposes.

PHYSICAL PROPERTIES OF PHENOLS

The important physical properties of phenol are

1. State and smell. Phen is the mourbes crystidine solids or a golds. They have characteristic phenoic adours

2. Solubility. Unlike should at phenous are appringly at able in water. The non-polar anyl group is very large in size and it almost completely masks the polar character of the OH group. However, phenous are somble in alcohols, ethers and also in NaOH.

9. Borling points. The limbing points of menors are higher than the borling points of the aromatic hydrocarbons and haloarenes of comparable motecular masses. For example, borning point of phenor molecular mass = 94) is 455 K while that of toluene molecular mass = 92 a 384 K

6—.å₁ H—Ö	S-I-B	ōH

Compound	C _e H _s OH	$C_aH_aCH_a$	C ₈ H ₅
	Phenol	Tohiene	Chiombeazene
Boiling point	455 K	384 K	4.45

The higher boiling point is due to the presence of intermolecular hydrogen bonding in phenola. Therefore, they exist as associated molecules.

CHEMICAL PROPERTIES OF ALCOHOLS

Alcohors are versatue compounds. They behave both as pucleophries as well as electrophy as

a They behave as nucleophiles in the reactions in which the bond between J-H is broken as shown below



b They behave as electrophiles in which the bond between C-O is broken. These reactions are carried out in the presence of soids to form promonted alcohols. Protonated alcohols react as electrophiles.

$$R-CH_2-OH$$
 $H \rightarrow R - CH_2 - OH_2$
 $Proformation altribut$
 $R \rightarrow R - CH_2 + H_2O$
 $R \rightarrow R$
Electrophile
 $R \rightarrow R$
 $R \rightarrow R$

On the basis of cleavage of different bonds, the reactions of alread is may be divided into the following types

- A. Reactions involving cleavage of oxygen hydrogen bond.
- B. Reactions involving cleavage of carbon-oxygen bond
- C. Reactions involving both the alkyl and hydroxyl groups

A. Renotions Involving the Cleavage of Oxygen-Hydrogen Bind

1. Reaction with active metals—acidio character. Alcohola are weakly and on nature and react with active actula such as socious, setasoum magnes and a more in the stellar agency and form metal altotade. For example,

The above reaction shows in all on its are northern instance. The alcohols are as Bronsted and a because they donate a proton to a strong base (; Br). For example,

On reacting an alkoxide with water, the starting alcahol is obtained

This reaction shows that water is a better proton donor than alcohol. In other words, water is stronger acid than alcohols. We can also note that alkazide is a better proton acceptor than hydroxide ion. This means alkoxides are stronger bases than hydroxide ion. For example sodium ethoxide is a stronger base than sodium hydroxide.

The andomature of almost is due to the presence of polar O+H bond. Oxygen is more electronegolive than aydrogen and therefore in withdraws the shared electron pair between O and H alongs awards itself. As a result.

O—H band becomes weak and uses a proton (H*). Therefore, alrohols behave as acids. However, alrohols are weak acids $K_{\alpha} = 10^{-6}$ to 10^{-6}) even weaker than water $K_{\alpha} = 1 \times 10^{-6}$. This is quite expected because of the electron releasing inductive effect, at leffect, of the alky group of H_2 . The alky group releases electrons lowerds oxygen atom and increases electron density over the oxygen atom tending to becrease the polarity of O. H band. As a result, the tendency of oxygen to withdraw electrons in O—H band towards, itself decreases and therefore, the release of proton (H*) becames difficult. On the other hand, there is no electron releasing alkyl group a water and the electron pair of O—H band gets more attracted towards oxygen atom that: in alreadon. Thus, the release of H* from water is easier in this alignsty less in alcohol. Thus, alcohols are neader needs than mater.

$$H \longrightarrow C \leftarrow H$$
 $R \leftarrow O \leftarrow H$
Water Alrohol

Comparison of acidic strength of different types of alcohols

The order of acidic strength among various types of alcohols as

primary > secondary > tertiary

This order can be easily explained in terms of electron releasing inductive effect of a is a groups. The acidic character of strohols is due to the cleavage of O—H bond giving H^*

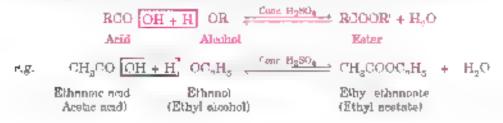
The alkyl groups are electron releasing groups. If effer and they note see the ron density around the wygen. As a result, the electrons of O—H band cannot be withdrawn strongly towards, saygen, and O. H temains strong. Therefore, greater is the number of alkyl groups present smaller with be as sendency to release proton. His and consequently weaker will be its acide strength. Now electron releasing effect would be maximum in terminy alcohols and least in primary alcohols. Thus, the acide character decreases as

Obviously the basic strength of their alkomides follows the reverse order

It may be noted that alcohols art as Lewis bases also. This is due to the presence of lone pairs on oxygen which makes alcohols proton acceptors

Reaction with motal bydrides. Alcohols react with metal bydrides to form alkowides with the evolution of hydrogen gas.

3. Reaction with carboxylic acids (esterification). Alcohols react with monocarboxylic acids, in the presence of conc. H₂SC₄ or dry HCl gas as catalyst, to form esters. The reaction is known as esterification. The function of conc. H₂SC₄ is to act as protoneding agent, as well as a debythrating agent.



The reaction is reversible to nature and the eq. b. bring can be shifted towards the forward threshop by removing water as soon as a 1s formed. When HCl gas is used as a catalyst, the reaction is called Fischer-Speier esterification.

It may be noted that the presence of bulky groups to the alcohol or in the acid decreases the rate of esterification. Thus is further to steric 4 advance of a dky groups. As a result, it is difficult to prepare esters of termary alcohol. Thus, the order of reactivity of alcohols in esterification reaction follows the order.

$$CH_0OH > CH_2CH_2OH > (CH_0)_2CHOH > (CH_2)_3COH$$

The order of carboxylic acids follows the sequence

$$HCOOH > CH_{3}COOH > CH_{3}CHCOOH > (CH_{3})_{3}CCOOH$$

Note: It is important to note that esterification applies the cleavage of the Ω . It bond of alcohol. This has seen established by cortopic tracer technicles. If the reaction is carried out with a root is, while softopic oxygen Ω^{12} (which can be easily traced because of its radioactive properties), the resulting esterior many this isotope of oxygen.

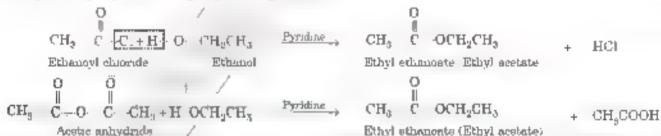
If the C \sim bond of alcohol would have cleaved during esternication $^{-1}$ a and have gone to resulting water

 Reaction with Griguard reagents. Alcohols react with arguer at reagents which are alkyl magnetium askides, RMgX) to form hydrocarbons.

NOTE

It may be noted that alkane formed corresponds to the advyl group of the Grignard reagent.

6. Reaction with acyl chloride or acid anhydride acylation). When also old are treated with acid of londe or acid anhydride in the presence of bases, the pyridine or dimethyl antique (as catalyst), the hydrogen atom of the group is replaced by acyl (RCO—) group forming esters.



The reaction is called acvious or reaction. If the end to ide or analydrate used are acetyl of on te and acetic ar hydride, the reaction is usually as ed acetylet in which means the introduction of acetyl CH₂CO group in accords. It may be noted the the reaction with acetyl chande is corned but in the presence of a case, pyndime to neutralise HC which is formed furning the reaction. It shifts the equal by an or the forward direction.

B. Reactions Involving Cleavage of Carbon-Oxygen Bond C+ H

Alcohols undergo a number of reactions involving the cleavage of carbon-oxygen, C—OH' bond. In these reactions, the order of reactivity of alcohols is

tertiary > secondary > primary

This can be explained in terms of electron releasing inductive effect of askyl groups. The alkyl groups release electrons and, therefore, they increase the electron density towards exygen. As a result, the polarity of C—O bond increases and this makes the cleavage of the bond between carbon and exygen easier. Therefore, the greater, the

number of askyl groups attached to the carbon, we more easy would be the recovery of C. O bond and consequently, the greater would be the reactivity of alcohol.

Thus, the reactivity follows the sequence

Reaction with hydrogen halides. Alrehols react with hydrogen halides to form he calkanes (alkyl halides).
 The order of reactivity of hydrogen halides is

This is because I for is a better nucleophile than Br fon, which in turn, is be ser than Cl son

The order of reactivity of alcohols is

Tertiary > Secondary > Primary

These trends have already been explained. Due to the low reactivity of primary and secondary alcohols with HCl, they require some Lewis and natalyst for the reaction in these reactions, anhydrous ZnCl, is used as a Lewis and natalyst. However, no such natalyst is needed for the reaction of tertancy alcohols with HCl.

The reaction of primary and secondary atrobots with HCl gas in the presence of anhydrous ZnG₂ is called **Groove's method**

In the case of HRr, a small amount of conc. H_aSO_4 a also added as a catalyst for the reaction with primary sucobols. But no catalyst is added for the reaction with secondary and tertiary alcohols which get dehydrated in the presence of conc. H_aSO_4

In the case of H1 adkyl radicles are formed by heating the around with H1

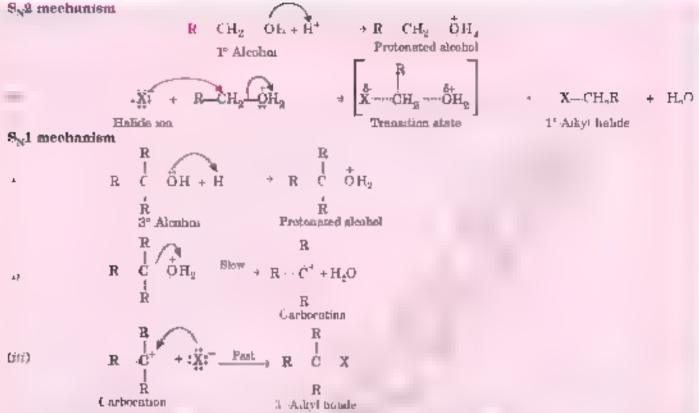
However, if reaction between hydrogen odde and attohol is carried out in the presence of red phosphorus, according to reduced to rydrocarbon rather than to form a ky hande. For example,

$$CH_aCH_aOH + 2HI \xrightarrow{\text{Red P}} C_aH_a + I_a + H_aO$$

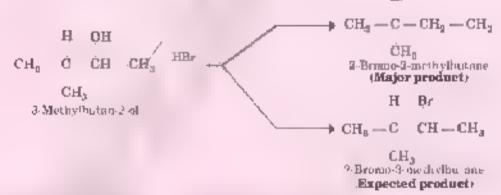
() red or 100 : Reaction of alcohols with hydrogen halides.

The renotivity of the above reaction can be easily understood in terms of its mechanism. Primary simbols react by $S_{\rm v}2$ mechanism whereas secondary and vertiary alcohols react by $S_{\rm v}1$ mechanism as

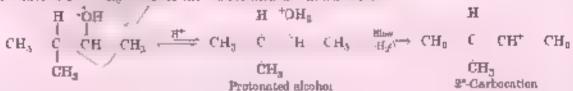
$$H \cdot X \rightarrow H^* + X^*$$



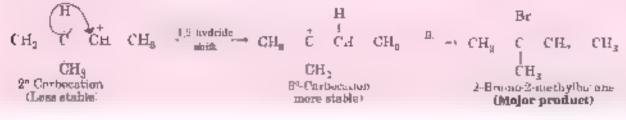
The reaction of 2° or 3° are note by $S_{\rm K}1$ mechanism. The offer gives rearranged products which are different from the expected products. As already learnt in Unit $_{\rm c}$ $S_{\rm ph}$ reactions of alkylorishes, thus is the trial,2 yielded or 1.2-methyl shift. For example, when 3-methylburan-2-or is wested with concentrated HBr the major product is **2-bromo-2-methylbutans**, betain of the expected 2-bromo-3-methylburane as



The is because if represinger on, of the surbocation as shown below.



A hydride shift transforms the 2° carbocation into a more stable 3° carbocation and altack by bromide ion gives the observed major product.



Similarly neopentyle, cohol. CH_{1/2}CCH, CH reacts with HBr to give 2-brome-2-methylbutanes as rearranged product. This is due to 1, 2-methyl shift as shown below.

2. Reaction with phosphorus halides. Phosphorus handes such as POI_4 . POI_5 PBr_3 $P + Br_4$ or PI_4 $P + I_6$ react with alcohols to form corresponding baloalkanes.

 $\mathsf{PBr}_{\mathfrak{p}}$ and $\mathsf{Pl}_{\mathfrak{p}}$ are generally prepared in with Ly the reacting between phosphorns and bromme or indiae

9. Reaction with thionyl chloride. Or treatment with thionyl chloride at the presence of pyridme, alcohols form chloroalkanes. For example,

The reaction with throny chromic is preferred because the by products. SO, and Ct, formed are gases and can be easily removed from the reaction mixture.

Reaction with ammonia. When vapours if an a round and ammonia are possed over heated a number An□_g, at 633K, a mixture of primary secondary and terhary armies is produced. For example,

C. Reactions involving both the Cleavage of Alayl and Hydroxyl Groups.

Acidic dehydration. When alrebols are heated with a protonic sold such as cond H₂SU₄ or H₂PO₄ at 448 K, they get dehydrated to form alkenes.

$$\begin{array}{cccc} C & \stackrel{\text{H}^+}{\longrightarrow} & \stackrel{\text{H}^-}{\longrightarrow} & \stackrel{\text{H}^$$

r.g.
$$H$$
 C C H H^* $+43$ K $+43$ K $+43$ K $+43$ K $+43$ K $+43$ K $+44$ $+44$ K $+44$ K $+44$ K $+44$ K $+44$ K $+44$ K $+44$ $+44$ K $+44$ $+$

Secondary and tertiary ancohols are dehydrated under anid conditions. For example,

Thus, the relative case of delays ration of absolute follows the solowing order Tertiary alcohol > Secondary alcohol > Primary alcohol

Acidie dehydration of alcohole

The reaction is beneved to occur as follows:

f Formation of protonuted alcohol. Alcohol combines with a proton to form a protonuted alcohol.

177 Formation of carbocation. The protonated around loses a water molecule to form a carbocation

(eff Elimination of a proton to form alkene. The carbocation then eliminates a proton and andergoes rearrangement of electrons to form the alkene.

The acid used in step — is released in step w — To have the equilibrarian reaction in the forward furnction, ethere is removed as soon as it is formed

Some Important Facts about Dehydration of Alcohols Reaction.

• The acidic dehydration of alcohols to alkenes occurs through the formation of intermediate carbocations and the stability of carbocation follows the order $-3^{\circ} > 2^{\circ} > 1^{\circ}$. Therefore, the relative case of dehydration of thiologs follows the same order

 The deliveration of 2° and 3° alread a gavery occurs in accordance with Saytzet's rule. According to this rule, the more highly substituted alkene is always the major product. For example,

prone the dehydration of alcahols involves the formation of intermediate carbocations which are if ways براتات to rearrougements, therefore, the alkenes formed are always those obtained from rearranged carbocots has In the dehydration of 2-methy/butan 1 of the major product is 2-methy/but-2-ene instead of expected 2-methy/but 1 ene because of 1,2 bydride abuft as

I may be noted that from S'-carbocation, the H' can be a considered either from C 1 or from C 3. But it is preferably abstracted from C-3 to form more substituted a kene a accordance with Saytzeff's rule.

Similarly 8,3-dimethylbutan 2-of gives 2.9-dimethylbut 2-ene as the major product instead of expected

3,3-dimethy, but-1 ene because of 1, 2-methyl shift as

$$\begin{array}{c} \operatorname{CH}_{3} \\ \operatorname{CH}_{4} \\ \operatorname{CH}_{3} \\ \operatorname{CH}_{4} \\ \operatorname{CH}_{5} \\$$

It may be noted that the rejection between alcohol and $\cos (H.S0)$, depends upon the conditions . For example,

(a At 448 K it gives ethene as the product.

in, When heated with excess of alcohol at 418 K, it forms an ether-

At 383 K, ethy sicohol and sulphane acid reset to give ethyl hydrogen sulphate

When ethyl hydrogen subplace is heated to
$$\pm 1^{\circ}$$
 K in the presence of excess of accobal, bethyl ether is formed.
 H_0 CH $\frac{1}{2}$ ISO $_0$ H \pm H; OCH $_0$ CH, $\frac{4.8 \text{ K}}{2}$ CH,OH $_0$ CH $_0$ CH, \pm H,SO $_0$
Ethoxy ethers

When ethyl hydrogen sulphate is bedied to $448 \, \mathrm{K}$ in the presence of excess of concording there is formed

ALCOHOLS PHENOLS AND ETHERS

Dehydration of alcohols to ethers or a kenes car also be brought about by passing the vapour of the elcohols over heated alumina entalyst under different conditions

(a) At 519-528 K, ethers are obtained.

2 Oxidation The oxidation of alcohols involves the formation of a carbon-oxygen domine bond with decyage of an O—H and C—H bonds.

This type of cleavage and formation of bonds occur in modution reactions. These reactions are also called **dehydrogenation reactions** because these involve pas of hydrogen from an alcohol. The product of conduction reaction depends upon the type of alcohol primary secondary or tertiary occupion of alcohol primary secondary or tertiary occupion of alcohol primary agent.

The condation of alcohols can be carried out by a number of reagonts such as aqueous, alkaline or acidified $KMu\Omega_q$, are affect Na₂Cr₂O₃ or K₂Cr₂O₃, arters and, chromic and see H wever different classes if anothols differ from each other not only in their case of exidusion but also on the nature of products formed

(r Primary alcohols. A primary alcohol is easily undised to form first an aidehyde and then a carboxylic acid. Both the aidehyde and the acid formed contain the same number of carbon atoms as the starting alcohol.

For example,

Storig withsing agents such as one first parassum; behromate convert a calcula directly to carboxylor acida. However, outdown can be stopped at aid-hyde stage by using or VI reagents to anhydrous medium such as CH, VI as the exidence agent.

The common respense used to stop immation of 1° alcohols to sidehyde stage are

- Calline reagent CrO_AC_H_N. chronwam trionide gyridine complex.
- POC CrO₂ \[\(\frac{1}{2} \text{H}_2 \text{N} \) HET as \[\text{H}_1 \text{NH} \] CrU₂ \(\text{Cr} \) pyridinsum chinrochromate
- PDC (C₀H₀NH)₁¹⁶ Cr₂U₂¹⁷ pyridmium dichromate
 It may be noted that these rangents are very selective because these are useful for exidation of alcohols which contain C—C double or criple bonds, allylic or benzylic C—H bonds.

$$CH_8$$
— CH — CH — CH_2OH
 \xrightarrow{PCC}
 CH_8 — CH — CH — CH

(iii) Secondary alcohols. A secondary alcohol is easily condised to form a ketone with chromic anhydride $-r \cup_{q} r$. The ketone may be further condised under strong conditions to form a mixture of soids. While the ketone contains the same than let of carbon atoms as the storing alcohol, the acids formed contain lesser in amber of carbon atoms.

OH

CH₂—CH—CH₂CH₂CH₃
$$\stackrel{\circ}{\longrightarrow}$$
 CH₃—C+CH₂CH₃CH₄CH₆ $\stackrel{\circ}{\longrightarrow}$ CH₄ OOH + HOOCCH₆CH₃CH₇CH₇ Penceur-2-one Aretic and Proposite and

The exidation can be stopped at the ketone stage by using chromic an hydride. $Cr\Omega_{p}$

Tertiary alcohols. Tertiary alcohols are very difficult to be exidised in neutronic alkaline KMnO₄ soultion because they do not have hydrogen on carbon bearing. OH group However, when rested with acide existing agents K.Cr.O₇/H.SO₄ or KMnO₄/H₂SO₄ anner very strong conditions of elevated to be a ureal area, cleavage of various C—C bonds takes place. As a result, mixtures of ketones and carboxylic acids are formed. Both the betones and acids conditions resear attacker of carbon allows have the starting anothels. The or with a presentably occurs we alkene formation through dehydration of alcohols under acidic conditions. For example,

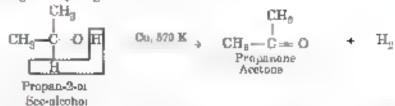
R U Curlous ...

2-Methylbutan-2-ol

- Etim or is generally used for druking purposes. If a person consumes methodol by quistake, then now the person is treated for methodol poisoning.
- Fourgeon is notation of methania are ethanol occurs at the only and produces the corresponding aidelive and then the carboxylin and. Meri and is explained first to nethania and then to methania and white ethania is as liser first to ethania and one is ethania and if an archeology person, by matake, druks denotorated archiolate, eithania mixed with methania the methania and antiferioral matania planters at reaced a giving attravenous of basis of a title ethanial about 1 % southway. Ethania gets preferencedly exchange own the exclusion of nethania. ACHO to methania and is swamped allowing time for knowly to excrete methania.
- 8. Dehydrogenation. The helydrogens are remove of hydrogen of a phore is achieved when the vapours of aucohol are passed over copper heated at 573 K. Whereas the primary and secondary anothols get easily deliveringenated to form aldenydes and ketones respectively, tertiary alcohols get legydrated loses water molecule, under the reaction conditions to alkenes.
 - () Primary alcohols get dehydrogenated to form aldehydes.

(Under strong

in Secondary alcohols get dehydrogenated to form ketones.



or Terhors alcohors get dehydrated on treatment with hot reduced copper to form alkenes.

CHEMICAL PROPERTIES OF PHENOLS

The phenois are reactive compounds. The chemical properties of phenois are of three types

- A. Reactions of phenolic group (OH group.
- B. Reactions of benzene ring
- O. Special reactions

A. Reactions of Phenolic (=OH) Group

1. Actdic character. Phenols are weakly acidic in nature $(K_p = .0^{-3} \text{ to } 10^{-10})$. They turn blue atmus red and react with alkali metals and alkalies to form their solts. For example,

Sedium phenomde

However phenoiss weaker acid than carboxvlic acid. Therefore this carboxytic acids, phenol does not react with soil not carboxate. Na, CO_{π} and sothers by a channel NoHCO $_{\pi}$ even ring CO_{π}

The andic character of phenon a because of the presence of polar O. H group. The hydroxyl group in phenon is directly attached to the spin hybridised carbon of benzene ring which acts as an electron withdrawing group. Due to the higher electronegatively of spin hybridised carbon of menon to which —OH is attached, electron density in oxygen necroses. This increases the principly of O. H bond and results in an increase in consistion of phenois. As a result H* ion can be easily released from aqueous solution as

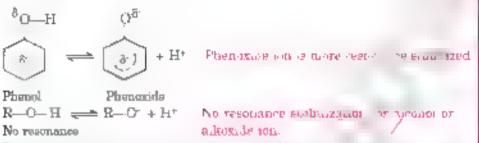
Phenols are more acidio thun alcohols. The greater acidic character of phenois as compared to alcohols can be expanded on the basis of resonance. Phenoi is a resonance hybrid of the following structures

It is clear that three structures of phenof HI, IV and V have +ve charge on oxygen of $-\Theta H$ group. This oxygen

attracts the electron pair of O. H bond strongly towards itself weakens the O. H bond and therefore, facilitates the release of H^* Similarly, the phenoxide ion is resonance stabilized as follows:

Thus, we observe that both phenol and phenonide ion are stabilized by resonance. Now if we carefully observe the resonance structures, we observe that phenonide on is more resonance stabilized their phenon in phenol three contributing structures III. IV and V have boun positive and negative charges and therefore, these which is unsuable. These structures we recommed no separate the charge and therefore, we is a unsuable. On the other hand, there is no structure in phenonide ion which requires charge separation. Thus, the resonance hybrid of phenol is easistable than phenoxide on and the reaction is very much in favour of the memorial ion. Therefore, the phenoxide more acidic.

On the other hand in case of aicohols, neither the skeohol nor the alkoxide ion is stabilized by resonance



Thus, phenois are more acidic than alcohola. However, phenois are less acidic than carboxylic acids which is supported by their dissocration constant K_{ϕ} values

The andie character of an and is expressed in terms of K_a is sometim, constant.

The stronger the acid, the larger will be its K_a value.

Afternately, K_a may also be expressed as ρK_a , which is defined as $\rho K_a = \log K_a$.

Smaller the ρK_a value, stronger in the solid.

Compound Ethanol Phanol Ethanol and 10⁻¹⁰

Effect of Substituents on the Acidic Character of Phenois

The effect of substitues is on the last meter of phenois can be costly understood at letter of stability of phenoisde ion relative to phenoi. Any group they sushblizes the phenoisde ion more than the end would make the reaction more towards forward direction and would increase the acidity. In the other hand, a group that makes the phenoisde ion less stable would decrease the andity.

a Electron withdrawing substituents (EWG) are NO₂₀ CN X theogeth our withdraw electrons one haperse the negative of the annexed on Therefore these substituents are objective in the premate of relative of phenois. Thus, there around with no rease the around strength.

Electron withdrawing group withdraws electrone disperses the negative charge and therefore stabilizes the phenoxide only wirit internal.

Acidir strength increases.

Electron donnting group donntoe electrons, intensifies the vel charge and observed destablises the puenoside on whit poenosi.

Acidso strength decreases

ch Electron donating groups (EDG) ike—R a kyl—NH_c—OR a koxy , etc give electrons at 1 or energy the negative charge in pinen a le ion. Therefore, these substituents describilize the phenoxide ion red ave to phenoi. Thus, these groups will decrease the audic character. The acidity constant (pK_n) of some phenois are given below

Electron withdrawing groups		Electron releasing groups	
Phenoi	pK _n	Phenol	pK ₀
p-Chiorophenol	9.38	g-Amunophenol	.D.46
p. Bromophenoi	9 35	p-Methoxyphenol	10.21
p-Nourophenol	7.5	p-Mesky, phenol	10 17
2. 4, 6-Trinitrophenol.	0.60		
	Phenn:	p.98	

to the —CH group. This means that noted part continues a —be more under the in a trophenous which continues to the —CH group. This means that noted part continues a —be more under the in a trophenous which of an appropriate points forestly, will be less acids than m-cresol.

Thus, scidic strength		phenol > m-Nitrophenol > I	henol		
Similarly.					
· ·	Phenol > m-Cre	so) > p-Cresol > o-Cresol			
Alcohol	ρK _u	Agerral	ρK		
o-Nitrophenol	7 22	o-Uresoi	10.28		
or Natrophenol	8.90	m : -resol	B0.01		
p-Nation-sensor	7 15	/ dispersion	10.14		
Presence of to me three	one substituente also, arrec	se, or learnages the audie st	netigith		
For example,	For example,				
2, 4, 8-Transtrophenol > 2, 4-Denscophenol > p-Natrophenol > Phonol.					
pK _o	0.7.	4 5 7 15	B9 98		

COMPARISON OF ACIDIC STRENGTH OF PHENOLS

(a) Comparison of acidic strength of nitrophenols

m-Nitrophenol

The nitro group \cdot NC, has both R effect and I effect But the R effect predominates over the I effect. Due to strong electron withdrawing nature of N group, all the nitrophenois are more acidic than phenoi. When NO group is present at σ and ρ positions, it withdraws electrons of the O—H bond towards it by stronger R effect whereas when NO, group is present it is position, it withdraws electrons of O—H bond only by weaker I effect.

When NO₂ is at o-and p-position the conjugation is extended up to oxygen atom of the intro group and the amon is more stable than its introphenoxide where no such renjugation is possible.

It is clear from the above structures that when $-NO_3$ group is at o-and p-positions, the phenoxide in is more resonance stable because the conjugation is extended upto integer atom of the introgroup. But the m introphenoxide ion is less stable because no such conjugation is possible in its structures. Thus, ϕ and p-introphenoxis are more acide than m-introphenox. The arger acide character of ϕ introphenoxis only because of A effect as shown

However a-astrophenol is slightly weaker acid than p-intropheno because of intramolecular hydrogen bonding which makes loss of a proton little difficult.

(b) Comparison of acidic strength of cresols (methylphenols)

Methyl group—CH, has +1 effect and hyperconjugation effect. But the hyperconjugation effect predominates over +1 effect. Both these effects, increase the electron density in the interpolation has but the issue of proton becomes after difficult. Hence, all the creats are increased proton becomes after difficult. Hence, all the creats are increased proton phenol. Since hyperconjugation effect can operate only at o-and p-positions and

NO.

-1 rffeet to
m-Nutruphonnl

O-H O

in a-Nitrophenoi

not through m-position, therefore, o and p-cresols are less scidic than m-cresol. However, as we know that +I effect of a substituent decreases with the increase in distance from the reaction returns therefore, +I effect will be more at a possition than at p-position. Due to stronger +I effect at n-position than at p-position of mention accurately accurately accurately provided in the position of a position of mention accurately accurat

Phenol >
$$m$$
-Cresol > p -Cresol > o -Cresol $pK_a = 9.98$. $(pK_a = 10.08)$ $(pK_b = 10.14)$ $(pK_b = 10.28)$

(c) Acidio strength of aminophenols and methoxyphenols

However when NH_n group or NH_n group is present at m-position it cannot push electrons into the C- H bond because negative charge cannot move to the carbon stom to which R- R- bond is attached.

Since NH, group cannot exert +R effect at m -position, therefore it exerts only. I effect. Therefore, two-hdraws electrons from all the nuclear positions of the inner m_0 and hence withdraws electrons of O—H bond. As a result, the electron tensity is Ω —H bond decreases and hence m summorphenolis more acidic than p- and p-ammorphenols.

OHH.

Similarly m-methoxyphenol is more acidic than o-and p-methoxyphenols due to -1 effect of $-0.0^{\circ}H_{g}$ group. Now -1 effect of methoxy group $-0.0^{\circ}H_{g}$ is to be than that of $-NH_{g}$ group, therefore -2 methoxy; denotes to be and/or than m-animo phenol. Thus, saidic strength is

$$m$$
-Methoxyphenol > m -Aminophenol > Phenol $pK_n = 0.68$ $(rK_n = 0.87)$ $pK_n = 0.38$

On comparing σ - and ρ -methoxyphenols. +R effect on σ -position is less than at ρ -position because of steric hindrance. As a result, the increase in electron density in G- H bond is less in case of σ -methoxyphenol than ρ -methoxyphenol Consection by σ -methoxyphenol consection G-methoxyphenol consection G-methoxyphenol G-methoxyphe

Thus, the acidic strength is

$$m$$
-Methoxyphenol > o-Methoxyphenol > p-Methoxyphenol $\rho K_u = 0.08$ $\rho K_u = 10.21$

(d) Comparison of acadic strength of halophennis

Hangens have both +R effect and A effect but A effect medominates were the +R effect Therefore, all balophenols (except p-fluorophenol) are more acidic than phenol. As we know A effect decreases with distance therefore, acidic strength of halophenols is

O. H.

o-Halophenol > m-Halophenol > p-Halophenol

Amongst a-harophenois, the acidic strength of to uphenola decreases as ill effect of the imagen decreases except for a-fluorophenoit a Fluorophenoities the weakest and due to the presence of strong in ramal ecular hydrogen bonding.

$$\begin{array}{lll} \rho\text{-Chloroff torophenol} &> \rho\text{-Homophenol} &> \rho\text{-Independent} &> \rho\text{-Fluorophenol} \\ \rho K_a = 8.11) & (\rho K_a = 8.39) & (\rho K_a = 8.48) & (\rho K_a = 8.81) \end{array}$$

2. Action with zine dust. When heated with zinc dest, pieno, is reduced to herzene

3. Action with ammonia. Pheno, reacts with ammonia in the presence of anhydrous zine chloride to give antime

4. Action with acid chlorides and acid subydrides (acylation). When treated with acetyl chloride—of the presence of pyridine or acetic analydride—of the presence of small amount of conc. H.SO, esters are formed. This reaction is reversible in nature. The pyridine basic removes HCI formed. It also shifts the equilibrium to the right and side. The introduction of acetyl group. CH₃. Co. in phenois is known as acetylation resistion.

Acetylation of substimental produces aspirin acetyl salicylar acid, which has an algebra, anti-inflammatory and anti-pyretic properties.

When phenyl acetale is heated with anhydrous Air is t undergoes rearrangement in which anyl group migrates from the phenyl arrayed to an ortho and para positions forming ortho and para hydroxy keroms. This reacts in is called Fries rearrangement.

Phenyl acetate

o Hydroxyaoetopheuona

p-Hydroxyacatophenone

Mg(OC, H₃)I

Phenuxy

 Action with benzoyl chloride benzoylation. Phenois react with benzoyl chloride in the presence of aqueous NaOH to form phenyl benzoate.

Pisenol.

Phenyl benzoste

This reaction is called Schotten Baumann reaction

6. Reaction with Gingmard reagen. Like account phenois also react with Ginghard reagent to form alkanes.

C_0H_5OH	+ CH ₂ MgI	→ CH ₄
Phem.	Methyl magnesion	Methane
	rodide	

NOTE

As in case of alcohols the alkane formed corresports to the aikyl group of the Grignari reagent.

B. Reactions of Benzene Ring. Electrophy is Substitut. a Beactions

Apart from reactions that careetly affect the OH group, thenois unergo encurophile aromanic substructions. As the OH group is an activating group, these reactions occur at a faster rate than reactions of benzene itself. The OH group is ortho-para directing at 1 therefore, incoming group comes at intho or paraposition. This is due to the reason that because of electronic effects caused by OH group, the ortho and parapositions become electron rich as shown below.

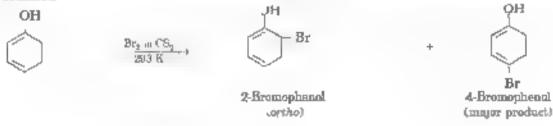
o- and o-positions are electron rich sites

Some common examples are

Bromination. Phenol reside with browning water (agreeous solution to give a precipitate of 2-4, 6-tribromopheno).

 4. 6 Tribromophenol (White ppt.

However, if the reaction is carried out in CS, or CS, at a low temperature, a maxture of ortho and parabromophenol is obtained.



ALCOHOLS PHENOLS AND ETHERS

It may be noted that the usual halogenation is carried out in the presence of Lewis soil. FeBr₃ which polarises the halogen molecule. In case of phenoi, the polarisation of bromine occurs even in the absence of Lewis and. This is because if highly actuating effect of |OH| group on the tenzene ring. The reaction is betieved to the first as

Explanation. In equeous solution, phenoliconizes to give phenoxide ton. Due to the presence of the negative charge, the hayger atom of the phenoxide on donates electrons to the herizene ring is a large extent. As a result, the ring gets highly activated leading to the formation of trisubstituted product. In the other hand, to the non-polar solvents, the marginal of menoi does not occur to a large extent. As a result. The group donates electrons to the henzene ring only to a small extent. Consequently, the ring is activated sughtly and, therefore, only monosubstitution occurs.

2. Nitration. Phenol reacts with direct outre and at low temperature. 208 % to give a maxture of ortho and para mirrophenol.

4-Nitrophenol (para) (30-40%)

The ortho and para isomers can be separated by stering distribution o-Nitrophenol is steam volatile due to attribute less that the localise condition of molecules. The cause of intermolecular hydrogen bonding which causes the association of molecules.

With conc matrix said, in the presence of susphuric acid, phenol gives 2, 4, 6-trimbrophenol pieric said. The yield of matro product is low because of the incidation of ring by conc. HNO_3 .

Now a days proposite 15s on pared by treating thereof first with cond. H.SO₃ at 378 K when a mature of 2-when sulphone and and 4-phenometric and is formed. This maxture is then bested with cond. HNO₃ to form 2.4 6-wind-replaced pione and in about 90% yield. During this reaction, introduce with supulmentarial replacement of the sulphone and group (desulphonation) by intro-group occurs.

9. Nitrosation. Phenol reacts with introl sand. NaNO *HCD at low temperature 286 K. to form p-introsonhead. The reaction which is not results substitution by in rose group. NO is called **introsation.** The p-introsophead can be further oxidised with dil. HNO₃ to give p-introphenol.

Therefore, the above method is used to get petter yie, I of autrophenois

4. Sulphonation. Phenol reacts with cone sulphone acid to form a maxture of a sub-pollenoi sulphone acid. At low temperature '288 K' ortho isomer is the main product while at higher temperature '378 K' the pure isomer predominates.

When 2-hydroxy benzene sulphonic and is heated to \$73 K, it gives thermodynamically controlled 4-hydroxybenzene sulphonic acid.

6. Friedel Crafts Alkylation. When phenons nested with a kyl habites in the presence of anhydrous as immunicationde, it forms cresols. The reaction is raised for idel - rafts alkylation reaction.

The yield of alkyl phenois is generally low because A.Cl., coordinates with the oxygen atms.

C. Special Reactions of Phenol.

Kolbe's reaction. When sod up phenoxide is asked with carbon drivide at about 4.0 K and under
4 to 7 atmospheric pressure sodium sancylate is formed as major product. This on acidification gives sancylic acid.

A small amount of pure isomer is also obtained and if the temperature be allowed to rise above 4.0 K, the pure isomer dominates. The reaction is called **holbe's reaction**. In the Kolbe's reaction, carbon diccide acts as the

electrophile. The mechanism involves the attack of N_{c_0} on highly activated phenomes ion.

The reaction is usually carried out by allowing sodium phenomics to absorb carbon dioxide and then healing the product to 400 K and 4-7 num pressure. First unsushie intermediate is formed which undergoes a proton shift. to form sodium salicylate. The subsequent scidification of sodium salicylate gives salicylic scid.

Salicylic soid is the starting material for the manufacture of a number of important compounds. For example

to Aspirin 2-sectory beazons soid. It is obtained by aretylating sancyle and with aceste anhydride and cone H.SO. Aspiriu is used as autopyristic to lower cody temperature, and analysing to relieve pain

(ii) Saker openy subsylate. P may be prepared by heating usin be said with phenor in the presence of phosphoryl chloride Salol is used as an intestinal an isoptic

(u) Methyl salzcylate .constituent of oil of winter green - a prepared by refluxing salcylic and with methyl airchol is is ised in perfumery as a flovouring agent

OH

COOCH +
$$H_3$$
OH

 H_4 OH

Methyl salicylate

Reimer-Tiemann renotion. When phenol is refuxed with chloroform in the presence of aqueous sodium. hydrocode at 340 K followed by hydrocysis an aldehydic group − CH→ gets introduced in the ring at a position orthologic benoing group. In the bytering benzaldebyde or eatry laidebyde is formed as the product of the reaction.

2 Hydroxy benzaidehyde Saucylaldehyde

Unstables

This reaction is called \mathbf{Reime}_{r} -Tiemann reaction. In authors to o-salicylaidelyde, small amount of p-salicylaidelyde. is also formed but the major product is ortho-

- Magdaggaras :

The Reuner-Tiemann reaction revolves electrophilic substitution reaction in this case the electrophile is dichlorocarbene. CCL This is generated by the reaction of chloroform. LHCl_a and NaOH as

$$CHCl_8 + OH^- \rightarrow H_2O + CCl_8 \rightarrow Cl^+ + CCl_2$$

Dichioricarbane

Dichl procarbene contains carbon atom with sextet of electrons and hence is a strong electrophile. The electrophilic substitution reaction occurs as

In Reimer-Tremann reaction, carbon tetrachloride may also be used in place of chloroform. In this case o-subcybr acid is formed as the major product.

8. Coupling reaction. In the alkaline medium, an in-rold solvta in of phenol combines with an ire-rold solvta in of her zene do zon, an chronide to form coronred an intences called azo dyes. This reaction is called coupling resistion.

Reaction with phthalic anhydride. Phenol reacts with phthalic anhydride in the presence of cone. H₂SO₄ to give phenolphthalein.

Phenol (two mujectica)

ALCOHOLS PHENOLS AND ETHERS

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- 5. Condensation with formaldehyde. Phenr condenses with formaldehyde in the presence of drackables ratelyst to give a cross-linked polymer called takente. This reaction has been discussed in letter, in Unit 15.
- 6. Hydrogenation or reduction. Phenomen be hydrogenated in the presence of finely divided makel catalyst at 688 K to give cyclohexanol.

Phenon Phenon undergoes condution with shrows and and produces a conduction with shrows a second conduction.

7 Oxidation. Phenol indergoes exidation with chromic acid and produces a conjugated disctone known as p-benzequinone

When exposed to air phenola are allowly exidused to cark coloured mix lives continuing quinoues.

Phenor can one be exidised by potassium per sulphate $K_0S_0O_8$ in alkaline so ition and gives a maxture of caterbol and quinol.

This reaction is called Elbs persulphate exidation.

8. Reaction with ferric chloride. Phenols react with the trail ferric chioride to form coloured water somble complex composities. Different micross give different on most will let, red. green, blue, etc., and therefore, this reaction serves as a test for phenols.

In fact, all compounds containing enobe group .= C—OH, give this test

C. Libermann's test. Most of the phenols give this test. On warming with conc. H.SO₄ and sodium nitrite, phenols give red or brown colourshop. The colour changes to blue or green by the addition of squeous Na∪H.

Phenois react with it trues and to give p-tatersophenol which rearranges to quinone. In the presence of rance H_aSO_d quinone condenses with phenot to give indophenol which is red. With excess of NaOH, sodium saw of indophenol is obtained which is blue.

This test can be used to distinguish phenols from alcohols.

DISTINCTION BETWEEN PRIMARY SECONDARY AND TERTIARY ALCOHOLS

Primary secondary and technical acohole can be that inguished by the following teats reactions.

1. Lucas test. In this test, an alcohol is treated with an equimolar mixture of concentrated hydrochloric acid and an aydrons ZnCL, celled Lucos reagent. The alcohols get converted into alkyl haviles. Since the alkyl in idea are not libe in water their formation is indicated by the appearance of turbid to in the reaction mixture. Since the order of reactivity of alcohols with halogen acids is tertiary > secondary > primary, the time required for the appearance of cloudiness will be different in different alcohols and this test helps, in distinguish them from one another

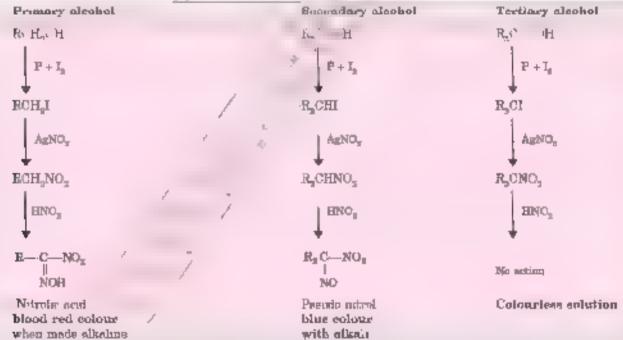
$$-\stackrel{\uparrow}{C}-\stackrel{\bullet}{C}H+\stackrel{\bullet}{H}Cl \xrightarrow{Ankyri. ZaCli_2} -\stackrel{\uparrow}{C}-Cl + H_2O$$
Alkyl chloryde

- w, If turbidity oppours immediately the alcohol is tertiary
- If arbidity appears within five minutes, the alcohol is secondary
- t. If arbidity appears only upon heating, the atrohoc may be primary
- 2. Victor Meyer's test. This test involves the following steps

The given alcohol is treated with red phosphorus and rodine resulting in the formation of corresponding alkyl rodide

- . The askyl odide is treated with silver intate to form correque lang introdkane
- 7 The autroalkane is finally reacted with nitrous soid in NaN in + di. H.St., and the resulting solution is made alkaline.
- Formation of a blood red colour and raises the primary alcoh a
- Formation of a blue colour shows the original alcohol is to perconduct while
- A colourless solution means that the alcohol is a tertiary alcohol

The different reactions taking place are shown below



The primary secondary and tertiary alcohols can also se distinguished by the following tests, which have already been discussed.

- Oxidation reaction (Property C. 2).
- Reduction with copper metal at 578 K (Property C 8).
- lodoform Test

All alcohols containing CH₂CH - group linked or cyclics or hydrogen atom - e methyl carbinous can be dishinguished from other alcohols by indoform test. This test is performed by heating the alcohol with aqueous Na. H

or Na $_{-0}$ and solution. On warming the reaction mixture, yellow prempilete of solution indicates positive indeferm test. For example, ethanol gives indeferm test as

```
OH
        Thus the alcohols containing CH,-CH
                                                          group give positive tode form test. Therefore indoform
        test can be used to distinguish between
0

    i) Ethanol (CH<sub>a</sub>CH<sub>a</sub>OH) and methanol (CH<sub>a</sub>OF)

           Ethanol gives this test.
D
      (a) Ethanol (CH,CH,OH) and propanol (CH,CH,CH,OH)
           Ethanol gives this test-
           Propan 2-al. ( H. CH CH., and propan 1-al. H. CH H. CH
                              ÓН
F
           Propan-II-of gives this test.
O
           CH_1CH - CH_1 + 4I + 0NBCH
                                                           H + H. Cut Na + 6Na. + 5H t
                ÓB.
                                                         Yellow put
             Proper-2-ol
R
           CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH + I<sub>2</sub> + NaOH A No reaction.
γľ
        → Butan 2-of CH<sub>2</sub>CH<sub>2</sub>CH CH<sub>3</sub>, and . cond 1 do H<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>3</sub>CH<sub>3</sub>OH).
                                  ĎΗ
T
            Butun-9-of gives this test.
           CH, CH, CH CH<sub>2</sub> + 4I + 6NaOH + CH<sub>3</sub> + CH, CH COONa + 5NaI + 5H, O
E
                     ÒН
                                                         Yellow ppt
8
                 Phian-2-ol
           CH_CH_CH_CH_OH + I_ + NaOH → No reaction
TP.
                 Butme I al
```

INTERCONVERSIONS OF ALCOHOLS

(a) Primary alcohol into secondary alcohol. For example,

(b) Secondary alcohol into tertiary alcohol.

(c) Primary alcohol into tertiary alcohol.

(d) Lower alcohol into higher alcohol (ascent of series).

(e) Higher alcohol into lower alcohol descent of series).

DISTINCTION BETWEEN ALCOHOLS AND PHENOLS

Alcohols and phenois can be distinguished by the following tests

	Test	Pheopl	Alcohor
1.	Litmus test	Phenota sam blaz s in te red	Alcohole do not have any offert on literan nelution.
2.	With ferric chlorade solution	Picenous result with neutre. FeCl, sol there to give characteristic colours the green male).	Arcohols do not give say rolour with neutra. Fedd _a solution
I.	Bromine water test	Phenots are white ppt, with bromuse water due to the formation of 2. 4 detribromophenol OR Br White par	Alcohole do not give white ppt with Br_{g} water
1.	Coupling reaction	Phenois give coloured des quellos orange or red. with ice old somition of bencene diazonium chloride Ng [Cl + H] OH Azo dye	Alcohole de noi form any dye with benzene diazonium chieride
5.	Sodiam hydroxide solution	Phenote react with sodious hydroxide rotation and form rodous half.	Alcohous do not react with sections by drom de solution
3 .	Libermann's test	Phenois give red colouration an warming with sodium nitrate dissolved in cond. H.SO., The colour changes to blue on the addrive of NaOH	No relote is produced.

MUTER EXAMPLE

Example &...

Arrange the following sets of compounds in order of their increasing bothing points

- (a. Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol,
- (b) Pentun-1-ol, n-butane, pentanal, ethoxy ethane.

N.C.E.R.T.

Solution . Increasing order of boiling points

- σ Mathanol < ethanol < propan-1-ol < butan-2-ol < butan-1-ol < pantan-1-ol</p>
- b. n-Butane < ethoxy ethane < pentanal < pentan-1-ol

■ Example 8.=

Name the reagents used in the following reactions

- a dehydration of propan-2-or to propene
- e acidehon of primary atcahel to an atdehyde.
- (e) cyclonevanone to 1-ethylcycinhexanol

to amedian of promisery weekol to carbaxyue acid

- id butan-2-one obutan-2-ot

a 85% HaSira 443 K b makalina KMnf , a Pirit of NaBH, it. is a "HaCHaMgBr ether. Have Solution

□ Example 7. ■

Convert phenol into

- (i) Baheylaidehyde
- (Hr S.B. 2012,
- (h) Benzene /

(Hr. S.B. 2012)

- full Pirms acid.
- Hr. S.B. 2012.
- The Benzone and

Hr 8.B. 2005

u Asptra

- HP S.B. 30,05
- · r Saveyese acid
- Hr S.B 2012, Meghaloya S.B 2018

Solarium

Phenui

Salicytaidehyde

Phenol

Benzeite

+ 3HNO_x

Profit add

Phecol

Beuzene

Tolaene

Deuzoic acid

OH



Phenol

QNa

400 K

Kolbe's resolion

HOCOOH

Saluydie neid.

 $OCOCH_0$ COOR

Arpirin

2 Hydroxybenzoic acid Saucylic Acid

Unstable

Example 8...

Write the structures of the major products expected from the following me, some

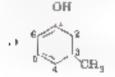
Monantiration of 3-methyl phenol

. Dimitration of 3 methyl phenoi.

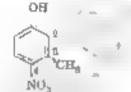
(iii) Mononstration of phenylethanoute

V.C.R.R.T.

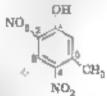
Solution Both OH and CH_a groups are of and pridareting. Therefore position 2.4 and 6 are activated. But due to storic hindrance, substitution does not occur at position 2, i.e., in between two groups.



$$\begin{array}{c} \text{HNO}_3 \cdot \text{H}_2\text{SO}_6 \\ \hline \text{Nurstine} \end{array}$$



4-Percept angue Tribenol 2-Nitro-6-mothylphenol



2,4-Ditutre-5-methylphenor

) OCOCH_{at} is a postured agree in the steric handrance, populated predominances



NO₂ d-Nitrophenyl etheroste (mayer)

9-Nitrophenyl ethanomie

□ Example θ_a

Complete the following reactions

$$b = CH_{0}CHCH_{0}CHO + \bigcirc MgBr = 0 \text{ if } Ether \\ cH_{0} = CH_{0}$$

(e) CH,CH,CH,C=CH -

Oxymercuration reduction

proceeds accoming to Markov-

A.I.R.B. 2017

mitov rule

⁶ Hg/ΩA₁ , θ₂O ⇒ NaBH₂ NaOH ⇒

ΩĦ CH-CH. 1 Phonylothenol

Example 10.

in Arrange, the following compounds in the introducing order of their and strength p-cresol p-nstrophenol, phenol

Write the mechanism fasting curved arm a unitation of the following receivor.

(a)
$$CH_0 = CH_2$$
 $H_2O^+ \rightarrow CH_3 - CH_2^+ + H_2O$

Write he structures of the products when butan 2-as reacts with following a ROCL in CrO₃

Or

Sc atten

a p-cresol < phenol < p-nitrophenol</p>

$$b = \frac{H}{H} + H = \frac{\dot{Q}}{\dot{Q}} + \dot{H} + \dot{H}_{2}\dot{Q}$$

OH

Butan-2-of Chlorofraname

Example 11.

How are the following conversions carried out!

(i) Benzyl chiande to benzyl alcohol

(Hr.S.B. 2018.

(a) Methylmagnesium bromide to 2-methylpropan-2-or.

(itt) Propene to propan-2-ol

ic Ethylmagnesium chioride to propon I-or

(D.S.B. 2010, 2019, Hr.R.B. 2018.

Example 12.

How would you obtain the following Beasoguranne from pheno: 3 2-Metholprop = 2-or from methyl magnesium brounds. (iii) Propon-2-of from propens (A.I.S.B. 2011. OH $Ma_{\gamma}Ce_{\gamma}D_{\gamma}$ Solution (/) Phenal Весондинальна OH **OMgBr**

Example 18.

How will you convert

h, Propene to propon-2-of

tia, Propon-2-ol to proponene

Propens

tu. Propene to propon 1-of

Phenol to 2, 4, 6-trustrophenol

Phenol to 2, 4, 6-tribromophenox

tore Ethapal to propon-2-of (D S.B. 2013

ÒН

Fragam-2-al

Example 14-

How will you convert.

(i. Propan-2-of to 2-methylpropan-2-of

(h) Aniline to pheno:

hn. Ethanol to proponenitrite

fiv. Phenol to tocaene

(v. Formaldehyde to ethanol

(D S B. 2018)

D S.B. 2018.

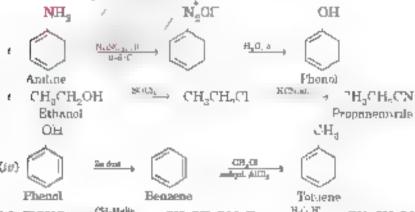
A.I S.B. 2018

A.I S.B. 2018

CH,

A.I S.B. 2018

 CH_a CHn So. aften > CH. CH CH_{Λ} ÒН OH2-Methylpropen-2-ol Propan-2-al



 $H_{i}O_{i}H^{i}$ CHICHIOH (v) HCHO CH₂CH₂OMgBr Ethanol Formaldebyde



7 Five the structure, formulae and IUPAC names of the somers with the molecular formula C₂H₃. Arrange them in increasing order of their boiling point.

•Ans. (i) CH₂CH₂CH₂OH .ii) CH₃ CHCH₃ (iii) CH₃OC₂H₅

Propan-1-01 Methoxyethone

Propen-2-al

The increasing order of boiling point f(n) < f(n) < f(n)

Which structures isomer of "H on cannot be dehydrogeneted by copper at 575K"

• Ans. CH_{ata}COH

 Arrange the following in order of increasing reactivity towards Lucas reagent, butan and 2-methylpropen-2-of butan-2-of.

· Ans. butan 1-ol, butan-2-ol 2-methylpropan-2-ol

10. What is the major product when butan-2-ol is heated with H₂SO, at 445 K?

• Ans. CH, CH = CHCH, But-2-ene)

- What products are obtained when ethyl arcohor in treated with H₀SO₄ at 443 K. 4.3 K at ≈ 363 K?
 Ans. J ethens in athory ethans in athyl hydrogen sulphate
- What happens when test butyl account is treated with reduced copper at 57 K?

Ans. 2-Methylpropens is obtained.

Complete the following reactions

CH₃

CH₃

4. Arrange the following in the decreasing order of arrain strength: H. 11,0H H₃,4 HoH

Ans. H₀D > CH₃OH > (CH₃I₆CHOH)
 What is the main product formed when phenol is subjected to Kolbe's reaction?

· Ans. Salisylic acid.

16. Arrange the following in the increasing order of andic strength phenoi ethanol e-introphenol

Ans. Ethanol, phenol, a-ostrophenol.

17. What happens when phenol is hydrogenated?

Ans. Cycloheranol is formed.

- 18. Two someon aromatic compounds a and B have the molecular formula C..H₂OH. A gives purple colour with FeV₆ solution while B does not. What are A and B?
 - · Ann. A to creeol B to benzyl elechot
- 19. Identify X, Y and Z in the following reactions

20. Give a method of converting beazens to phenol via nitrobenzens.

$$\bullet \ \, \mathbf{Ans.} \quad \ \, C_g H_g \xrightarrow{H \cap O_{g_1} \cdot H_g \otimes O_{g_2}} \cdot C_g H_g N O_s \xrightarrow{\mathbf{Sn. HCl}} \ \, \bullet \ \, C_g H_g N H_0 \xrightarrow{\mathbf{Nn} \setminus O_{g_1} \cdot H \cap I} \ \, \bullet \ \, C_g H_g O H$$

21. Predot which is stronger acid in each of the following pairs

a Phenol or evolohexanol

.5: Phenol or p-mtrophenol

c p. Nacrophenol or p-chiorophenol

d' 2, 4, 6-Transcrophenol or 2, 4-duritrophenol

e: p-Cynnophenal or phenal

(☼ (CH_{ala} CHOH me (CF_{ala} CHOH)

g. Phenol or beautyl alcohol

Ans. a Phenn) b. p-Nitrophenol (c p-Nicrophenol (d) 3, 4, 6-Trantrophenol ω μ-Cyanophenol β F_{1,1} HoH ig Phenol

23. Predict the product of the following reaction

(Hydroboration reaction proceeds according to anti-Markovnikov rule.

SOME COMMERCIALLY IMPORTANT ALCOHOLS

1. Methunol

Methans or methyl aronol is also knows as wood spires in wood acrobal because it was originally prepared by destructive that latter of wood. Nowadays, it is must far ired by entarytic by tragenation of rathon monoxide or water gas. A mixture of carbon monoxide and by tragen is present over a catalyst, consisting of oxides of copper zinc and chromium at 578–678 K and under 201–810 atm. If your when methano is formed.

$$CO + 2H_{\gamma}$$
 $\xrightarrow{0}$
 $\xrightarrow{-Z_{D'}}$
 $\xrightarrow{-Z_{D'$

Methanol is also prepared as a by product asyring destructive distillation of wood.

Properties. Methanol is a colouriess mind with hip 387 K. It is miscible with water in all proportions. It is highly poisonous in nature and when taken internally it causes bindhess or even death. It gives most of the general reactions of alcohols.

Uses of Methanol. Methanol is used

- (:) as a solvent for paints and varnishes.
- as an antifreeze for automobile radiators.
- a in the manufacture of forms) dehyde which is very widely used in the manufacture of plastics.
- for denotaring ethy pleoholize to make t unfit for drinking purposes. Denotured alcohol is commonly known as methylated sport.
- (a) as a motor fuel.
- in) in the manufacture of perfumes, drugs and vernishes.

2. Ethanol.

It is the most important member of the alcohol series and is simply known as alcohol. It is also known as grain alcohol because it can be prepared from starchy grains.

It can be manufactured by the following processes:

Hydration of ethene. Ethanol is prepared by the hydration of ethene at 573 K, under 200 atm pressure and in the presence of a catalyst

$$CH_2 = CH_2 + H_2O$$
 $\xrightarrow{Erat \ 200 \ abs}$ CH_3CH_4OH Ethene Kthanoi

 μ Oxo process. Ethene reacts with carbon monoxide and hydrogen in the presence of cobolic carbonyl. For SO $_{\mu\nu}$ as calculated at high reimperature and press are to give aide axide. The relativity inydrogenution of aldenydes gives primary alcohous.

- Permentation of carbohydrates. Ethanol is manufactured by fermentation of starch or sugar. Fermentation. as a process in which complex organic compounds are broken down into air pier molecules by the action of biological. catalysis known as enzymes. Enzymes are complex organic compounds which act as catalysis in reaction calong place in timing organisms. These are also called bio-eatalysts.
- (a) Ethanol from sugar solution molasses). Molasses is a non-crysta, line form if eight obtained at the mother. aquor after cryetsiasatuu of sugar from sugar solution. This contains about 50% sugar — is diruted to about 40% solution. and years in addr- and kept for about 2-3 days. Yeast supplies the enzymes, overtage and symase. The enzyme invertage hydrolyses sucrose to garcese and fructose. The enzyme zymase found in yeast, converts glucose and fructose to ethanou

The fermented inquid which contains about 8- 10% ethanol is called ma.h. It is fractionally distinct to rectified spirit containing 95.0% account. Further televides, in with track time and 4% timing with sody an or calcium, gives 99.8% ethanol

(b) Ethanol from starch. Ethanol is also prepared industrial v from starchy substances like potato, barley yam, etc. Starchy substances are made into a poste by healing with super-heated steam at about 335 K and mait is added. The mait contains the enzyme divisions which converts stards into maitase

$$2(C_0H_{10}O_{0/n} + nH_2O \xrightarrow{Duantam} nC_{10}H_{22}O_{11}$$

Starch Multone

The product is cooled to about 305K and yeast is didn't. It gives enzyme incluse which converts and tose to glucose

In wine making, grapes are the source of sugars and yeast. As grapes ripen, the quantity of sugar increases. and the yeast grows or the skin of the grapes. When the grapes are crushed, sugar and enzyme come in contact. and fermentation starts. Ferments can take a place under anseroble conditions ωe^- in the absence of air. During fermentation CO, is released.

The action of enzyme is achieved when the concentration of alcohol exceeds 14%. If air enters the fermentation mixture, the 0, of the air condises ethanol to ethanoic and which spoils the taste of sirobolic drinks and makes of sour

Properties. It is a colourless, volatile again with characteristic pleasant idear. It is a boung point of 35.K. It gives all general reactions of alcohols.

Uses of Ethanol, Ethyl alcohol is used

- s so an industrial colvent for paints, acquere, dyse variation, ecomobics, perfumes, etc.
- u_i) in the manufacture of alcoholic beverages.
- in the preparation of ether chloroform, odoform acetaidehyde, aceta and, etc.
- in scientific instruments such as thermometers and spirit levels
- as an antifreeze in automobile radiators.
- vi) as a preservative for biological specimens.

out, as a fuel in spurit lamps and stoves.

(viu, in hospitals as an antiseptic

ar) in the manufacture of drugs. flavouring extracts, perfumes, etc.

Industrial Alcohols

Ethyl alcohol is one of the most important raw materials which is quite frequently used. It is sold in different grades of purity for different purposes. These are described by w

Absolute alcohol. It is 100% pure ethanol. The fermentation of carbohydrates gives ethanol commaning water. The fractional distillation of squeous solution of ethanol gives a constant boiling azcotropic mixture which common 95% ethanol. To get 100% ethanol, a smill amount of senzene is added with a mixture and their distilled. The first forth in lat 197 8 K consists of water ethanol and benzene. After the last fraction, at 141.2 K, one say if senzene and ethanol. Finally, pure ethanol is due better the last fraction, at 1.5 K.

Methylated sparit or denatured alcohol. It is 25% ethyl alcohol. To avoid the misuse of alcohol meant for industries for drinking purposes it is made unfit by mixing in it methans is some copper sulphate to give it a colour and pyndine is four smelling aquid, etc. The process is called dens aretion of alcohol and the alcohol thus obtained, is called methylated spirit or denstured alcohol. It is quite chosp and can be used for non-drinking purposes and particularly in industries.

Power alcohol. It is a anxiore of 20% ether if and 50% gast, in Since around does not now with recommendate for a construction of period and its innite dataral sources, setted generally remains an a short supply. The use of sower sicohol as a substitute for gasoline has promised bright income to hidde because we can manufacture large quantities of alcohol from molesses.

Alcoholic beverages. Liquors used for frinking purposes contain alcohol as the principal is a scenting age. These are also relieu alcoholic beverages. They are present from afferent substances and contain afferent period tages of contain There are a only two years of bever go and and topical and Under the beverages are present from grapes and if er first pures and are relevances. The liquors obtained by distinction have angled a contained and love cufferent trade a case of a statical process from grapes.

Toxicity of Alcohols

The toy city of alcohous a many without their uniting a explanar taking place it is one regards of the high combot is tag whose and the other highest considered by the control of the other physiological effects between a touty as the king. The indicate all many is notice after drucking a caxing in a connection which gives a construction of a control of the other gives a construction. In or takes i food sinciling liquid, it is known as renaturation, for or tout

4. Phenol or Carbolic seid

Phenol was first soluted from cost tar Nowadays, a manufactured by Dow's process from chlorobenzene or by cumene process.

I is constitled, hygrogroup in that he sould like theiring pinels is 3.5K and boiling count is 455K. The liquid form of phenoleunitaring about 5% was er as known as to but in the first pink in exposure to our and agent.

Uses of Phenol. Phenol is used

for the manufacture of bakelite by polymensing with formaldehyde

- a the marafact relof arigs like assume, salar phenocetral etc.
- with an an untraeptic in suaps, lotions, etc.
- for preparing phenolphthalem used as an indicator in and-base titrations
 - (c) as a preservative for ink
 - or for the manufacture of cyclohexanol used as a solvent for rubber and acquers.
 - and in the manufacture of azo dyes.
- (1994) in the manufacture of pieric said used in making explosives.

POLYHYDRIC ALCOHOLS

Li addition to according to cohors two polyhydron accords are also commercially apportant. These are the compounds which courses two or more hydroxy groups. OH in the molecule. The compounds which courses two OH groups are in led diols. Their IL PAC names are obtained by adding the suffix diol to the names of the parent alkane. The compounds containing three. OH groups are called triols. Their ILPAC names are obtained by adding the suffix triol to the name of the parent alkane. The two common examples are

 CH_0OH

CH2OH

CH₂OH

Ethane 2-dio Ethylene glycol) CHOH

CH_OH

Propose I 2 5-tmo: Glyceroft



C

N

C

E

P

U

Conceptual Questions === 1 ==

Q.1. Arrange the following compounds in increasing order of their acid strength

Propan . ol. 2. 4. 6-transtrophenoi, ultrophenol. 3. 5-danstrophenol, phenol. 4-methyl phenol. (N.C.E.R.T.)

Are. Increasing order of acid strength to

Propan a or. 4-methylphenor, phenol, 3-mitro phenor, 5-minitrophenol, 3, 4, 6-trimstrophenor

Q. 2. In the process of wine making, ripened gropes are crushed so that sugar and enzyme should come in contact with each other and fermentation should start. What will happen if anneroble conditions are not maintained during this process? (CBSE Sample Paper 2017-18)

Ans. Ethanol will be converted into ethanolo and

Q. 3. How will you distinguish between 1-phany ethanol and 5-phenylethanol?

Ana. . Phenylechand. C₈H₆ CHCH₃ concaton are grouping — CHCH₃ and therefore will give redeform test.

On the other hand 2-Phonyletteniol, CpH₂CH₂CH₂CH₃OH does not come as CHCH₂ group and therefore at will not give codeform test.

Qd. Sodium metal can be used for drying diethel ether and benzers and not ethanol.

Ans. Etnanol has a replaceable bydrogen atom and therefore, reacts with sodium

$$O_2H_0OH + Na$$
 $+ O_6H_0ONa + \frac{1}{2}H_0$

While benzene and diethyl ether do not have repraceable hydrogen atom and hence do not react with acdum. Therefore, these can be dried by sedium metal.

Q.5. Arrange the following compounds in the order of increasing boiling points

Ethanul, Propan-1-ol, Butan-1-ol, Butan-2-ol

(Kerala S.B. 2017)

Ans. Ethanol < Propan-1-ol < Butan-2-ol < Butan-1-ol

Q.6. Explain why alcohols are comparatively more soluble in water than the corresponding hydrocarbon.

Ana. The comparatively higher solubility of elections in water in comparison to hydrogen bonds between alcohol and water molecules.

Q.7 Arrange the following compounds in the decreasing order of their boiling points.

i) Pentan-1-ol (ii) 2-Methylbutan-2-ol

(iii) 3-Methylbutan-2-ol

Ans. 4.4 > 13. > 4. This is because with branching the shape becomes spherical and cherefore, van der Wants forces decreases. As a result, boiling point decreases

Q.S. What is Jones reagent? Give the product of omdation of

(if) CB₄CH=CHCB(OB)CH₂ by Jones reagent.

Ana. Jones reagent is CrO_3 in equeous acetone solution. This is a mild reagent so much a unidoses alcohols without analysing or rearranging double bunds

Q.9. Why has phenol higher boiling point then toluene?

(Ph.S.B. 2015)

And Phenol molecular mass 84 has higher builting point than believe molecular mass 82. This is due to be fact that phenol forms intermolecular hydrogen bonding leading to association of its molecules. Foresequently additional energy is needed to break hydrogen bonds which raises its bolding point.

On the other hand, coluene does not form bydrogen bonds and therefore, as boding pour, is less

Q.10. Out of phonol and benzene, which is more easily natrated and why?

Phenol can be more easily nitrated that benzing This is because will group it electron releasing group and it increases electron density on the benzine ring, postunitely at the ortio and pare postume. Since obtains involves attack of introducin (NO₂) on, its attack on phenon will be causer than on benzine where no electron releasing group is present.

Q.11. Why has phenol smaller dipole moment than methanol?

Ans. CH₃ group is electron related by group and therefore it increases the negative charge on the cayged atom to the the theoretic in the transfer of the tr

Q.12. Alcohols are easily protonated in comparison to phenols. Explain.

(A.I.S.B. 2010)

Ans. In alcohols, the electron releasing inductive effect + I effect of the alkyl group attached to the carbon having the 3H group increases he electron density on he oxygen atom. Therefore, alcohols are easily protonous

Protonated alcohor

In the other hand, in the case of phenoi, the oxygen atom acquires a partial positive charge due to resonance. Thus, it is not prokonsted. G

O

N

C

E

TUA

Ans

- Q.13. How do you account for the fact that unlike phenol, 2,4-dinitrophenol and 2, 4, 6-terratrophenol are soluble in equeous sodium carbonate solution?
- Ans. Nore group is electron withdrawing group and a mobilizes the phenoxide ion by dispersing the negative charge on the wygen. As a result, the action strength of more phenois is more than that of phenoi. This effect is more pronounced at α and ρ-positions. Therefore, 2 4-dimitrophenol and 2 4 6-transtrophenols are more ended than phenoi. As a result, they are stronger ands than carbonic and H. . Hence they react with Na₂, Ω₃ to form their corresponding solutions and dissolve in equecus solution, arbunate solution with the evolution of CO₃.
- Q.14. Why do alcohols have higher boiling points than haloalkanes of the same molecular mass?
- Ans. The boiling points of elcohols are higher than the corresponding helonikanes of the same molecular mass. This is mainly due to strong intermolecular by arogen bonding between elcohol undertiles. Because of hydrogen bonding in alcohols, energy has to be supplied to overcome the force of attraction and consequently holling points are high. No such hydrogen bonding exists in halosikanes. For example, b.pt. of CH₂OH is only 5 K white that of CH₂C is only 249 K.
- Q.15. While separating a mixture of ortho and para introphenols by steam distillation, name the isomer which is more volatile. Give reason.
- Ans. Or the autrophenous a more votatue. This is because it has weak introducerular hydrogen bonding while p-nitrophenol is associated with strong intermelecular hydrogen bonding.
- Q.16. Explain why ortho introphenol is more acidic than ortho methody phenol. H.P.S.B. 2015, A.L.S.B. 2015, Ana. This is because No., intro group is electron withdrawing group and will increase the +ve charge or rayger to make at more acidic. In the other hand, ACH, group is electron releasing group and will decrease +ve charge on oxygen making it less seidic as C—H band will not break easily
- Q.17. Write reaction for the preparation of phenol from cumene.

 Ans.

Uttarnkhand S.D. 2014.

Q.18. Complete the following reactions:

Hr 8.B. 2006,

- Q.19. A compound A) with molecular formula $C_4H_{16}C$ on oxidation forms compound (B). The compound (B) gives positive todoform test and on reaction with CH_9MgBr followed by hydrolysis gives (C). Identify A, B and C and give the sequence of reactions.
- Ans. Since B gives positive indefined test, it must be methyl betone $CH_3CUCH_4CH_6$ B. It will be obtained by the oxidation of 2-butanei (A. The reactions are

Q.20. A compound (A) reacts with the only chloride to give compound (B). B) reacts with magnesium to form a Grignard reagent which is treated with acetone and the product is hydrolysed to give 2-methyl-2-butanol. What are A, and (B) compounds?

OH

2-Methylbutno 2-ol

Q.21. An alkeride as a stronger base than hydroxide ion, dustify-

(CBSE Sample Paper 2012)

Ans. Due to the presence of electron donating alkyl group, there is high electron density in alkowed ion as compared to bydrowde ion. Therefore, alkowide ion is more basic than bydrowde ion.

Q.22. Why is ± butan-2-of optically inactive?

D.S.B. 2013, A.LS.B. 2018

Ans. ± · Botan-2 of represents recemir mixture of * · · butan-2-or and · · · 2-instanct which roles the plane polarised light in different directions but to equal extent. Therefore, ± compound is optically marrive.

Q.23. Write the EUPAC name of the given compound:

(A.I.S.B. 2018)

Ans. 2 Methylpropane-1, 3-dioi

Q.24. Write an isomer of C.H.OH.

(Ph. S.H. 2017)

Ans. CH₂OCH₂, Methosymethone

Q.25. Predict the product in the following reaction:

LP6. S.B. 2018)

Aug. Phenolphshalem

Phenol two malecules

Phenolphthelem

Q.26. Convert phenol to salicylic scid-

H. P. S. B. 2018, Meghalaya S.B. 2018

CONCEPTUAL



Ethers are the compounds having —O—as the functional group. The general formula of ethers is R—O—R where R may be alkyl or aryl group. Ethers may be classified as .

Aliphotic ethers in which R and R' are both alkyl groups. For example,

CH. O. CH.

CH. O-CH.CH.

Dimethyl ether

Ethyl methyl ether

Aromatic ethers in which either one or both R and R groups are anyl groups. For example,

 $C_nH_n = C_n + C_nH_n$

CoHe O-CoHe Diphenyl ether

Methyl phenyl ether

Aromatic ethers may be further sub-divided as

Ethers, a which one of the groups is any while the other is askyl are a led alkyl anyl others in phenolic ethers.

a Ethers in which both the groups are any are called draryl others. For example

 $CH_{a} = O + CH_{a}$ Dimethyl ether

(Aliphatic ether)

 $C_0H_0 = O + A^*H_0$ Methyl phenyl ether alkyl aryl ether)

 C_aH_a $O=C_aH_a$ Diphenyl ether diaryl ether)

Aromatic ethers

Symmetrical and unsymmetrical ethers. When the two a myl proteps in an other are same, the other is said. to be symmetrical or simple other. For example

CH.OCH.

CHICH O CHICH.

CaHar O-CaHa

Dimethyl ether

Diethyl ether

Diphenyl ether

When the two alkyl groups in an ether are different, the stars is said to be ansymmetrical or mixed ether For example.

CH.-O-CH.CH.

Ethyl methyl ether

Methyl phenyl ather

NOMENCLATURE OF ETHERS

According to common system, ethers are named according to asky group attachd to the arrigen atom. The names of the two alkyl or aryl groups unked to anygen are written as separate words alphabetically followed by the word ether For example.

CH, JCH, Dimethyl other

CH,OCH CA, Ethyl methy ether сн_яосиси_я

CH² O—C CH²
CH³
CH³

Methyl reopropyl ether

tert-Butyl methyl ether

Haran Piphenyl ether

 $H_s \cup \cup_s H_s$ Methyl phenyl ether

 $_{ij}$ H₂OCH₃CH₃ Ethyl phenyl ether

Some aromatic ethers have special common names. For example,

Phenetale

Methy phenyl ether

Ethyl phenyl ether

According to IUPAC system, ethers are named as alkoxyalkanes. The larger a kyl group forms the parent chain while ower alkyl group is taken with the ethereal oxygen and forms a part of alkoxy group. For example,

CH₂=0= "H₂

CH, JCH, CH,

 $O \circ H_5$

Methoxymethane

Methoxyethane

Methoxybenzese

Ethonybermene

Phenoxybenzene

If any other functions, group, a also present, then that group gets properly and becomes the propagation group For example

5-Methoxybutan-2-ot

2-Ethoxyethanol

Methoxyethene

4-Ethoxycyclohexene

The common and IUPAC names of some ethers are given below.

Table 1 Common and RUFAC names of some ethers.

Сощроила	Соптов ваше	IUPAC name
сносн,	Diametric etiles	Methosymethone
$C_{\bullet}H_{0}OC_{\bullet}H_{0}$	Therby 4 Hiller	Ethoxyethmae
CH ₂ OC ₂ H ₂ /	Ethyl methyl ether	Methocyethone
CH ₃ OC ₃ H ₇	Methyl n-propyl ether	1-Methoxypropane
C°H°OCH	Methyl phenyl ether comade	Methoxy bettzene
C ^H OC'H	Ethyl phenyl ether phenetole	Ethorybenzene
CoHook "Herok"Ha	Heptyl phenyl ether	1 Phenoxybeptane
сщоён ён, ён,	Methyl .sopropy- ether	S-Methoxypropane
CH,—OCH,CH,OCH,		1, 2-Dimethoxyethane
С _в н _в О Čн ₂ Čн ₄ Čн Čн ₃ Сн ₃	Ropentyl phenyl ether	S-Metaylbittoxybenzette
टा टेम, टेम रम,	Epichlorol vdna	3-СБдого 1. 2-ерохургораце

ASSESSED AND PLAN

Example 15. —

Give IUPAC names of the following

(a)
$$CH_3OCH_2CH_1 - CH_3$$

 CH_3

$$(b) \quad CH_sOCH_sCH_sCl.$$

CM_OCH_CM+ CH_

Solution: ILPAC names

an CH,CH,CH,OCH,

CH.

1 Methoxy-2-methy/propage

CHARLET HOLD

2-Cluoro-1-methoxyethese

NO. Ot Ha

4. Netro amanie

.d) CH.CH.CH.OCH.

1 Methoxypropage

-Ethnicypropade

 NO_q OC_nH_n

Ethory-2-introcycloberane

23. Write the Π PAC names of the following others whose common names are given

leapmost metay ether Phenetola in Schloro ethyl medly ether

4: Opriohesyl aspropyl ether эг пургаражусусія авалле

OCH, Br

24. Write the ILTPAC names of the following

ен, сиси,си, O€,af_s

a He God' "Hea

",H, KH,CH,CH,

TH_D HUCH,

Ans. / 2-Methoxymopane

B H,OCH,CH,OC,H

Ans. / 2 Sthirtyhntane

c 2-Methorypropone

a 1 Ethoxy-2-motocayethane

Write the structural formula of the following 25.

r: 2-Methoxy-2-methylpropune

c Ethoxy banzene an 1-chioro-2-methoxyechene

 Drumpropyt ether (iv) Phenetole

ii) Divinyl ether (v) p.Nitrophenetole

Anna.

CH, CH -O- CH - CH, CH. CH. OCH, CH,

7 CHL-CH-C-CH-CH,

OCH, CH,

ini) Bie (3-methoxyethyl. ether (iii) tort-Butyl methyl ether

22 Promomethoxy benzene

Ellhoxy benzene

a. CH,OCH,CH,O

ISOMERISM IN ETHERS

Ethers show the following types of isomerism

 Chain isomerism. These have the same alkyl groups on eather side of the oxygen atom but different arrangement of the carbon chain within the alkyl group or groups. For example.

1-Methoxybutane

3 Methoxy-2-methylpropane

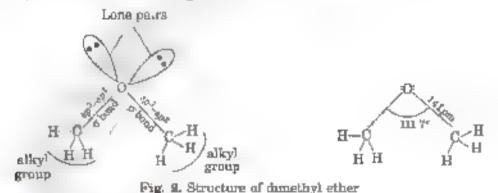
-Methoxybutane

Functional isomerism: Ethers containing two or more carbon atoms are functional isomer of alcohols.For example

 Metamerism. These ethers have the same molecular formula but d ff rent alkyl groups on either ade of the oxygen atoms. For example

STRUCTURE OF ETHERS

Eithers have structure summar to that of water $H_n = n$ if t asse, exygen undergoes sp^0 hybridisation forming low sp^0 hybridisation. Two of the folds sp hybrid orbitals of the early groups forming again t bonds. The remaining sp^0 would orbitally if exygen contains a ione pair of electrons each as shown in Fig. 2. The C—C—C bond angle in others is tetrahedral angle. For example, in dimethy, ether, the C—C—C bond angle is 111.7° and C—C bond is 141 pm which is almost same as in alcohols. The larger bond angle in eithers may be because of greater repulsive rate arbitrans between bucker askyl groups as compared to the smalter H-atoms in mater. Thus, ethers have bent or angular structure



METHODS OF PREPARATION OF ETHERS

Ethers can be prepared by the following general methods

1. Debydration of nicobuts

Alcohols undergo dehydration in the presence of protonor and such as H_*S_- , H_*PO error give either alkenes or ethers. The formation of product alkene or ether lepends pour the CH_*CH_*OH reaction conditions. For example, when ethanoi is bested with come. H_0SO_4 at 443 K, ethene is formed as the major product. However, at 413 K, ethoxyethane is obtained as the major product.

$$\begin{array}{c} \text{H}_2\text{SO}_3 \\ \text{443 R} \\ \text{Ethene} \end{array} \rightarrow \begin{array}{c} \text{CH}_2 = \text{CH}_2 \\ \text{Ethene} \end{array}$$

Thus, symmetrical ethers can be prepared by the dehydrotion of a cohors with conc. H₂SO₃ at 4.2 K.

The frequency of other as a prepared by hydrogen as substitution reportion. Substitution of the attack of the a

The formation of either is a care-oph the bimore-unar substitution reaction $S_{\rm M} 2$ involving the attack of the arcohol molecule on a protonated alcohol as given below

Formation of diethyl ether from ethano.

The mechanism for the fermation of diethyl ether from ethor, if at 418 K, a given below

..., Etbyl alcohol gets protonated in the presence of H*

Protonutes almand Ethyl sastanen lang

• Due to the presence of a +ve charge on the oxygen atom the carbon of CH, part of CH₂CH, becomes electron definent. As a result, nucleophilic stack by another stroked in acrust approximated occurs on the protonated alcohol with the elimination of a molecule of water.

air) Oxomum can loses a proton to form an ether-

$$CH_3 - CH_2 - CH_3 + H^*$$

$$CH_3 - CH_2 - CH_3 - C$$

This step is fast and hence does not affect the rate of reaction

This method is similable for the preparation of ethers having primary alkyl groups only

The following are some facts about the reaction.

. The formation of others may be accompanied by the formation of some amounts of alkenes. In order to avoid this, temperature of the reaction must be properly controlled because at higher temperature, 443 K the alcohols get dehydrated to alkenes.

A large excess of alcohols should be used.

tti. The alkyl group should be unhindered.

The above method is main visued for the dehydration of **primary alcohols** because secondary and tertiary alcohols follows g_{ij} is a keries as major primary and return of cohols follows S_{ij} 1 pathway. For example,

ALCOHOLS PHENOLS AND ETHERS

OF:

Thus, the order of delightation of a school to form ethers follows the order primary > secondary > tertiary

The debydration of alcohols may also be carried out by passing the vapours of alcohols over a bested establist like alumina (ALO.) at about 525 K.

$$C_2H_3$$
 OH_4 $+$ H_5 OU_2H_6 $A_{ay}O_{7}$ A_{ay}

Thus, for the formation of ethers, the alkyl group should be unhandered and the temperature be kept low otherwise the reaction favours the formation of alkene

Limitation. This nethod is generally not used for the preparation of unsymmetrics, ethers because invitures may be obtained. For example.

For example, ethylmethyl ether cannot be obtained by this method from methyl alcohol and ethyl alcohol

2. From alkyl handes by Williamson's synthesis

This is one of the best methods for preparing symmetrical and unsymmetrical coherent aboratory. In this method an alky, babile is treated with a statable sociam alkonde prepared by the naturn of sociam on a suitable alcohol The reaction myr ves inteleop, the substitution $S_{\rm N}2$ attack of an allow, e am on primary alkyl hance

Sodrum methande Ethyl brounde Ethyl methyl ether (Unsymmetrics) ether

Similarly, alkyl aryl ethers, phenolic others, can be easi. I prepared by treating phenoxide with a similable sikyl halide

NOTE

It may be noted that phenois are more acidic than archois and therefore, these can be converted to sodium phenomous by treating with NeOH. In account, metallic second is used to convert account to manufactures

Lamitation. It may be noted that for preparing unsummetrical ethers, the hadde used should **preferably be** primary because Wanamaon synthesis occurs by $S_{\nu}2$ mechanism and primary alkyl handes are most reactive in $S_{\nu}2$ reactions. Therefore best yields of unsymmetrical ethers can be obtained when athyl halides are primary. However the alkoxides may be primary accondury in tertiary. The secondary and tertiary alky incides if used may form awenes as major product due to elim nation process. For 2" and 3" a kyi his incere you can competes over substitution. If a 3° takel hande is used an alkene is he only product and no other a formed. For example, I we wan, to prepare tert buty; ethy; ether then we should take ethy, brounds and sod any tert butowde.

Sodium tert-butunda 32

tert-Butylothyl other

However if we use cert buty brounde and sodium ethoride as reactions, then the major products would be 2-methylpropene isobutylene) and ethanol,

The a second alkowdes are not only uncleaphnes or strong cases as well. They react with alkyl habdes reading to elimination reaction.

It may be noted that due to steme hindrance, secundary alky) halides also prefer to undergo elimination rather then substitution giving a mixture of both elimination inkenes and substitution tether products. For example,

CH, CH, CH, CH, CH, CN,
$$\frac{\text{confk}}{\text{CH}_3} \rightarrow \text{CH}_3 \rightarrow \text{CH}_4 + \text{CH}_4 + \text{CH}_5 + \text{CH}_5$$

Since secondary and tertiary alkyl halides prefer to undergo elimination rather than substitution, therefore, even symmetrical ethers construct a greecondary and tertury alkyl groups cannot be prepared in good yields by Will training a synthesis. For as, mile anapropylether, or detect a dylether cannot be prepared at good yie is by Williamson's synthesis.

Further alkyl aryl ethers, phenolic ethers, can be easily prepared by using sod um phenoxide and alkyl handes For example,

However, anyl halide and sodium alkoxide cannot be used for preparing phenotic ethers because anyl halides are less reactive towards uncleophilic substitution reactions than alkyl halides.

Similarly, this method cannot be used for preparing disrylethers because ary, halides donot undergo nucleophilic substitution reactions easily

8. From alkyl halides by treating with dry silver oxide

Ethers can also be prepared by heating an alkyl halide with dry silver oxide

2 molecules 4. By the action of diagomethane on alcohols

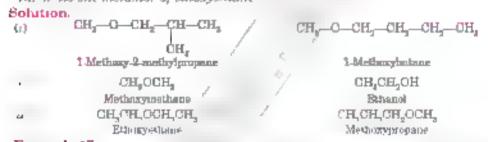
Methy ethers can also be prepared by the action of bazon ethane CH,N. on records in the presence of fluoroboric soid HBF, as a catalyst.



Example 16. —

(i) Write one chain isomer of 1 methoxy-2-methyl propane (ii) Write one functional isomer of methoxymethane (iii) Write one metamer of ethoxyethane

Ph.S.B 2009.



Example 17 Write equations for the preparation of the following claers by Wallamson's synthesis.

2-реорожеде

ic 2-Methyl-2-methorypropune o Ethory besitene To I-Methoxyethane e I Ethoxy-2 2-diniethylpropone id . Proponypropane Solutions ONa C, H, BrNeBr ů Sodium phenomiše Ethony benzene CHLCH,ONe ь CHLBr CHLOCKLOK NeBr Sodicen akhazide _-Methosyetbane Bromomethane CH. CH, CH, C-ONA St-CH, NaBr ,c) CH C-00H CH. CH, Sodium 9-methyl-Bromometheca 2-Mewyi-

2-methoxypropane

Practice Problems

- 36. Suggest three methods for preparing di-n-propyl other
- Suggest a methods to prepare ethyl-a -propyl ether acarting from alanhol of clares C-a one or less.
- 28. Name the major product in the following reactions.

(a)
$$C_1H_2ONa^+ + C_2H_2OI$$
 \Rightarrow (b) $C_2H_2OH + CH_2N_2$ (c) $CCH_2N_2CO^+ + C_2H_2ONa$ \Rightarrow (d) $C_2H_2Br + (CH_2)_2CO^+ + Na^+ / \Rightarrow$ Ans. a Ethomy benzene $C_2H_2(A^+)_2H_2$ \Rightarrow Esby methyl ether $C_2H_2(A^+)_2H_2$ (c) Isobutylene $CCH_2(A^+)_2COH_2$ (d) Tert-butyl ethyl ether

PHYSICAL PROPERTIES OF ETHERS

The unportant physical properties of ethers are

CH.

- 1 Physical state. Lower members thmethyl ether methyl ethyl ether are gases and ligher members are low boiling figures with a pleasant smell.
- 2. Dipole moments. Ethers have bent or angular arructure like water. Due to greater electronegativity of exygen than carbon the C Ω bonds are slighing polar and therefore the ethers have resultant dipole moment. Since the two + O bonds are notified to each other at an angle of about 1. I two dipoles do not concelleach other As a result, ethers have resultant dipole moment. For example, dipole moment of dimethylether is ± 3D and that of diethylether is ± 3E.
- Net dipole moment
- 3. Boiling points. Ethers have low a writy and as a result do not show only association by intermolecular hydrogen bonding. Therefore, ethers have low boiling points and liwer than that of sometic already and almost same as those of alkanes of comparable molecular masses.

The large difference in boding points of alcohols and ethers is due to the presence of hydrogen bonding in alcohols

The boding points of ethers precise with merease in number of carbon atoms. Due to weak dipole-dipole forces, the boding points of lower in others such as "methy" ether and ethyl nethyl ether are only slightly higher than those of the corresponding n-alkanes of comparable molecular masses. The boding point of diethyl ether is almost the same $807.0 \, \mathrm{K}$ as that of n-pentage $309.4 \, \mathrm{K}$ having comparable molecular masses. However as the hydrocarbon part increases beyond four carbon axims, the boding points of ethers are even slightly lower than corresponding n-alkanes of comparable molecular masses. This is because of the presence of oxygen atom: ether molecules are less symmetrical that n-alkanes of comparable molecular masses. Therefore, he van Jer Woods forces of attraction between ether molecules are slightly less than those to atthe more symmetrical n-alkanes of comparable molecular masses. For example,

Ether	CH2OCH2	CH₃OC₂H₀	$C_2H_b C C_2H_b$	$C_2H_4\cap C_6H_7$	C_2 H_4 OC_4 H_p
Molecular mass	46	60	74	88	102
Boiling point (K)	250	283	807.6	386.0	355

n-Alkana	Propane	n-Butane	л-Pontane	д-Hexane	n-Heptane
Molecular mass	44	58	72	85	1.0
Boiling point (K)	288	278	809,1	842	37.

4. Solubility. The solubility of ethers is comparable to those of corresponding alcohols of the same molecular mass. For example, like ethanol, dimethyl ether is completely massive with water.

Similarly both ethoxyethane and busin-1 of are so the in water to almost the same extent i.e. 7.6 and 9.0 g per x00 mL water respectively. On the other hand, pentane is almost transactible with water. So ability of ethers in water is due to the fact that like alcohols the oxygen of ether can also form hydrogen bonds with water molecules as shown below.

R O H O H

However the solubility of ethers in water decreases from lower members to higher members. This may be due to increase a size of the alkel group which decreases he

tendency to form hydrogen bonding. Ethers are however, fairly soluble in common organic solvents such as alcohols, chioroform, acetone, benzene, etc.

5. Density. All ethers are aghter than water

CHEMICAL PROPERTIES OF ETHERS

Ethers are parte mert and stable compounds. They are the least react to of the functional groups. These are not easily attacked by a keries to the transfer acids, active method, reducing agents or our using agents under ordinary conditions. This is because the functional group of ethers to does not contain any active sits in their molecules as compared to hydroxyl. OH group of accides or phetical even though the oxygen atom in both these functions, groups contains two lone pairs of electrons. However, under specific conditions, ethers undergo some chemical reactions. The important chemical properties of ethers are

A ! Reactions of Ethereal Oxygen

I Action of air (formation of peroxides). On exposure to sunlight, ethers slowly react with oxygen from air to form hydroperoxides or peroxides which are explosive.

In this case, the oxidation occurs at the early a from next to the ethered, hayger to form hydroperus, le-

These periodes are unstable compounds and a various because they decompose violen by on heating. Therefore, proper care should be taken while disulting the old samples of other. Serious accidents may occur during the distillation of the old samples contain some periodes.

The presence of percentles in others can be detected by shaking them with freshly prepared FeSO₄ solution followed by the addition of KCNs. The appearance of blood red colour indicates the presence of peruxides.

The periodes can be removed from e^+ era by shaking with either an aqueous solution of KI or ferrors a diplate. The other periodes are reduced to either and I ion is exidised to I_2 or Fe^{3^+} sales are oxidised to Fe^{3^+} sales. The Fe^{3^+} sales formed are removed from the reaction mixture by washing with water I_2 is removed by first shoking with solution three I_3 and I_4 and then washing with water. The resuming either is direct version against I_3 and then I_4 and to get periodic free pure either

Action with concentrated acids formation of execution salts. The exygen atom is ether molecule has
two one pairs of electrons. Therefore, ethers act as Lewis bases and dissolve in cold concentrated minera, acids
(H.SO_{is} HCl, to form salts called commum salts.)

$$R = O - R + H_0 SO_4 \text{ euc.}, \qquad \Rightarrow R = O \cdot R + H SO_4$$

$$H$$

$$I = \text{Relocator}, \qquad \text{hydrogen sulphate}$$

$$r.g. = C_n H_0 + H_0 SO_4 \text{ conc.} + \begin{bmatrix} C_2 H_0 & O - C_2 H_0 \end{bmatrix} H SO_4$$

$$H$$
 Diethylorousum hydrogen autphate

This reaction can be used to distinguish between ethers and alkanes because alkanes do not react with dilute ands.

3. Reaction with Lewis acids (formation of coordination complexes). Seing Lewis bases ethers form coordination complexes with Lewis acids such as BF₂, AlCl₂, FeU₁, etc. These complexes are called etherates

Similarly diethyl ether rearts with Grignard reagen, forming Grignard reagen, etherate

$$2(CH_{2}CH_{2}I_{3}O + RM_{g}X) \rightarrow (CH_{3}CH_{2}I_{3}O - X)$$

$$(CH_{3}CH_{2}I_{3}O - X)$$

Due to the formation of the etherate. Grignard reagents dissolve in either. That is why imposed reagents are assistly prepared in ethers. However, they cannot be prepared in decizing, because beazene has no lone pair of electrons and therefore, cannot form complexes with them.

B. Reactions Involving Cleavage of C-O Bond

 $B \rightarrow B + B \lambda$

Ethers are the least reactive of the functional groups. Perton-exygen bond in ethers can be cleaved under drashe conditions as given below

1 Cleavage by halogen acids. The carbon-oxygen bond of others can be cleaved by heating with hydrondic and HI and hydrobronic and HBr at 973 K to form at across, and an alkyl hance.

However, if excess and is used the alcohol first formed reacts further with the hatogen and to form alky bands.

The overall reaction may be written as
$$R = O - R + 2HX \qquad \stackrel{d}{=} 2H \rightarrow \qquad 2RX + H,O$$

$$excess$$
(HX = HI, HBr)

e.g.,
$$CH_1CH_2 - C - CH_2CH_2 + 2HI - 375 K + 2CH_2CH_2I + H_2O$$

Distribute there exercises Ethyr noticle

Some only cyclic ethers are energy cleaved by HBr or HI to form databalkanes.

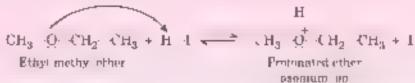
+ 2HI - 375 K + ICH_2 - CH_2 - CH_2I + H_2O

Tetrabydrofuran excess 4-Doodobutane

_______________Clenvage of C→O bond in ethers by halogen acids

The clearage reaction follows the following mechanism:

1 The other molecule being Lewis base gets protonated by the hydrogen of the and to form protonated ether or exemum sait



The reaction takes place with HBr and HI because these reagents are sufficiently under

2 Indide on 1 is a good aucleopage. The centra sted ether undergoes, unleading risitack by radials for 1 and displaces an alcohol molecule by $S_{N}2$ mechanism and therefore, forms alkyl alcohol and alkyl halide

 When H1 is a excess and the reaction is corned out at 1 gh temperature ethanol formed reacts with another. molecule of HI and is converted into ethyl rodide.

$$CH_3CH_2 \xrightarrow{O-H} + H \xrightarrow{H} \xrightarrow{H} CH_3CH_2 \xrightarrow{O-H} + T$$

$$CH_3CH_2 \xrightarrow{O-H} + H \xrightarrow{H} CH_3CH_2 \xrightarrow{H} + H_3O$$
Ethyl iodide

The order of reactivity of halogen acids is:

HI > HBr > HCI

As a series above, the cleavage of ethers, with nogen, across now was introposition actions by habite ton, X, on the protonned other. Therefore, greater the nucleophilicity of the annals ion, more reactive is the balogen acid. As we know nucleophilicity of the halide ions follows the order

 $\Gamma > Br > C\Gamma$

Therefore, the reactivity of the halogen acids follows the same sequence | c , HI > HEr > HCl

 Cleavage of unsymmetrical alkyl ethers (site of charvage. In case of insymmetrical ethers having two.) different alkyl groups, the alcohol and the o kyl made formed depend upon the nature of the alkyl groups, if promotive and secondary alkyl groups are present then the reaction occurs by \$2 mechanism. The habde ion attacks the smaller alkyl group because of less steric landrance. Thus, in case is unsymmetrical ethers with two different alkyl groups, the are of wearage is such that the haride is formed from the arky group which is smaller or axe. For example,

Isotoropylmethy' ether

The reaction may be written as

If, however, one of the alkyt groups is tertiary group, the askyt hasde is formed from the tertiary askyl group.

9-Indo-2-methyleropene

This is obtained the reaction now occurs by $S_{\rm g}1$ merbantism. The formation of products is governed by the stability. of the corbocation formed from the desvage of " O bond in the protonated either agontum ion. Since text butyl. carbocation $\mathbb{C}H_{3,3}$ " is more stable than the methyl carbocation. "H, therefore, cleavage of C—O bond gives a more stable carbocation $\mathbb{C}H_{3,3}$ " and methanol. Then, todade ion, I attacks this test-butyl carbocation to form tert-butyl rodide.

 Cleavage of alkyl arvi (phenolic) ether. With alkyl aryl others, phenolic where the cleavage in a hydrogen hande always gives phenol and a molecule of alkyl halide and not aryl halide and alcohol.

MOTE

Untike askyl a conous phenoidoes not react further with Hi to give anyt balids because of strong carbon-cayges bond to phenoi-

In case of amsole, methylpnenyl exonium ion C_0H_0 $\overset{\bullet}{O}$ — CH_0 is formed by the protonation of either. The bond $\overset{\bullet}{H}$

Therefore, alkyl habde is formed from smaller alkyl group. Thus,

N OF FORMED

• Cleavage of benzyl alityl ethers. In case of benzyl alityl ethers containing a primary alityl group such as senzyl nethyl ether, the reaction processe by $S_{\rm g}$ l mechanism. Since the benzyl carbocation is more stable than the methyl curbocation, the cleavage of C. O bond gives benzyl carbocation and methyl alcoho. The hande on their attacks carbocation to form benzyl sudide

• Cleavage of diaryl ethers. It may be noted that diaryl ethers such as diphenyl ether are not cleaved by HI This is because the C—O bonds have some double bond character due to resonance between the lane pairs of electrons on the ⊕ atom and the C mama of aryl groups benzene ring) directly bonded to the → atom.

Cleavage by sulphuric acid. On beeting with du H.St., inder pressure, ethers are hydrolysed to give elcohola.

$$\cdot H_1CH_2 \cdot O - CH_1CH_0 + H_0C \xrightarrow{\text{di} H_0SO_2} 2CH_1CH_0CH$$
Disthyl ether Ethanol

If canc, H.SO, is used, eithers form alcohols and ethy, hydrogen sulphates

Secondary and tertiary ethers, however, form alkenes with conc. H,SU,

 Cleavage with phosphorus pentachloride. Ethers reset with PCl₂ on reating to form alkyl chronide as a result of cleavage of C—O bond.

 Cleavage by acid chlorides. Ethers react with scetyl chloride in the presence of anhydrous ZnCl₂ to give alkyl halide and ester

However, with anhydrides only esters are formed.

$$(C_2H_6)_2O + (CH_2CO)_2O \xrightarrow{Aub_3d Z_2Ob_2} 2CH_3COOC_3H_6$$
The Abelly of the Acetic analysis de Herri Acetic analysis

C Reactions of Alkyl Group

Halogenation. Ethers react with chiorine or brozene in the dark to give substituted products. The extent
of substitution depends upon the reaction roughture. For example, diethy, ether reacts with chiorine in the dark to
give 1. I dichlorodiethyl ether in which the balogenation preferentially occurs at 4-carbon stoms.

However, in the presence of fight and excess of chlorine all the bydrogen atoms are substituted by chlorine aroms.

D. Ring Substitution in Aromatic Ethers

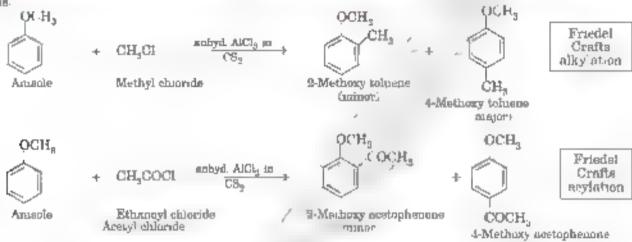
Alkoxy group is *ortho* and *para* directing and it directs the incoming groups to *ortho* and *para* positions. It activates the aromatic rung greates electrophilic substitution reaction in the same way as in alcohols as given below

As is clear that structures III. IV and V show high electron density at ortho and para positions as compared to meta position. Therefore, electrophilic substitution reactions occur mainly at a- and p- positions.

 Halogenation. Phenyl sikyl ethers andergo asual hologenation in the benzene ring. For example, brominatain of amsone gives ortho and pure brome derivatives even in the absence of iron. III. bromide catalyst. It is due to the activation of benzene ring by methoxy group.

Para somer is obtained in 90% yield.

2. Friedel Crafts reaction. Assole undergoes Fronts. Craft alkylation and acylation reaction of the presence of only from alumin on hander a Lewis and as catalyst a which alkyl and acyl groups are introduced at ortho and pure positions.



9. Nitration. When treated with a mixture of concert at— HNO, and H,Sr $_{\rm c}$ amade gives a mixture of cond p-nitro compounds.

It may however, be noted that eithers are relatively less reactive than phenois towards electrophilic substitution reactions

SOLVED EXAMPLES

Example 18.

Give the major products that are formed by heating each of the following ethers with HI

Solution .

Example 10. ___

The favouring in not an appropriate reaction for the preparation of a butyl either

$$CH_s$$
 CH_s CH_s CH_s CH_s CH_s CH_s CH_s

(i) What would be the major product of the reaction)

to. Write a six table reaction for the preparation of test-buty, ethyl ether.

W.C.E.R.T.

Solution : The disjor product of the given resculor is -methylproj. I one. This is because sodium athoride is a strong nucleopline as well as a strong base. Therefore, eminutation reaction, president as over substitution.

To prepare terr-buty) othy) other the mixyl brilde should be a chloroethane and the nucleophile should be soduum tert-buoxide.

USES OF ETHERS

Ethers are widely used as a solvents both or aborntory as well as in industry because of their almost mert nature and good dissolving power. Among large another a very common. The important uses of distingle other are

- L. Diethyl ether is an industrial solvent for mis, fats, gums, resins, etc.
- 2. It is used in surgery as an anaesthetic

Ethoxy ethane the widely menuned as an autofotion anneathetic. However, because of its allow effect and impleasant recovery period, ethoxy ethane, mainest reproced by other compounds such as ethrone and additione as anneathetics.

9. It is also used as a refingerable

- 4. It is also med as a reaction medium to LiAtH, reductions and Grighard synchesis.
- It is used as an extracting solvent in laboratory and industry.
- When mixed with alcohol it acts as a densturent and the mixture is used as petrol substitute under the trade name Natable.
- 7 It is used in perfumery and in the manufacture of smokeless powder.

Directly! ether a used in the form of compressed iquid as a refrigerant low temperature solvent and propellant for sprays. It is used used for storing food stuffs by freezing in direct contact lecause it does not leave any undesirable taste or smell.

Di isopropyl ether is used as an industria, solvent and for reducing knocking of petrol

Divinyl other is used as an anaesthetic and is considered better than diethyl either because of its rapid action and rapid recovery from smaesthesic

Phenyl ether has been used as heat transfer medium because of its high boiling point (631 K).

A number of nature by non-rang phenols and others particularly rang substituted acceptes are used as flavouring and in perfumes because of their piecesant odour. For example, anothols, a consistent of same seed, engenol-present in oil of cloves, vanillin-present in on of vanilla bean and thymol-present in thymine and mint are some common examples of phenols and others used in perfumes and flavourings.

add on

o

N C

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PTUA

Conceptual Questions == 2 ----

Q. 1. Write the structure of phenyl isopentylether.

(CBSE Sample Paper 2011

Q. 2. Ansade on reaction with HI gives phenol and CH_eI as main products and not codobenzene and CH_eOH.

A.I.G.B. 2016)

Ans. It this reaction protonated anisole i.e. methylphony oxonium on it first formed and then the hands on attacks this protonated anisole. Due to stem fundress of bulky phenyl proup, the attack preferably occurs to the alkyl group forming methyl sodids and phenol.

Q. 3. Why are ethers relatively mert compounds?

Ads. Ethers are mert important because the fluctions, group of others. On does not contain any active site. Therefore, under ordinary roads sons, they are stable to bases, dilute and each other contains and reducing agents.

Q. 4. Why dilect busy ether cannot be prepared by Wilhamson synthesis?

Ans. The prepare distert butyl either by Whitemeon's synthesis, we require town-butyl brounds and sodium test outbands. Some very butyl product is a 3° asky-bands, it prefers to undergo enumeration rather than substitution. Therefore, is obtained as the product rather than distort butyl ether.

Q.5. Name the pair of alkyl halide and alkoxide for the preparation of ethyl ferf butyl ether.

Ans. Ethyl rodids and sodium sert butoxide

Q. 6. What products are obtained when

Q. 7 HI is a better reagent than HBr for cleavage of ether. Exp ain

Ans. Hi is a stronger and han HBr and therefore, exemum son is readily formed. It is also a better nucleophile than Br for nucleophile substitution reaction.

Q. S. The boiling points of ethers are lower than their corresponding isomeric alcohols. Explain.

A.E.R. 2013, Meghalayo S.R. 2015, Ph.S.R. 2017.

Ans. Ethers have low polarity and therefore, do not show any association by interminential hydrogen nonding. On the other hand, their isomeric alcohols have strong intermolecular hydrogen nonding and therefore, their bound points are high.

Q. 9. Explain why rieavage of phenyl alkyl ethers with HBr always produces phenol and alkyl bromide and not bromobenzone and alkanols. (A.L.S. 2016)

Ans. This is because during the reaction, the actual of hands conforms to the protonated other. This is steric hindrance of builty phony, group, the attack occurs preferably to the autyl group forming alky, brounds

Q. 10. Ethers possess a dipole moment even if the alkyl radicals in the molecule are identical, Explain.

Ans. Ethers have angular structure similar to water in which ox gon involves sp³ hybridisection. Oxyget is surrounded by two O+R conds and two lone pairs. Due it suggests abdulouse eithers have dipole moment even if the two alkyligroups are identical because two C+O moments dit as respect each other. For example, amedly lether has dipole moment of 1.3.D.

Q.11. Why a non-symmetrical ether is not prepared by heating a mixture of ROH and R'OH in orid?

Ans. During this reaction a mixture of three ethers. R. O. R. and R.O. R'ss obtained

Q.12 How do you account for the muscibility of ethoxyethane with water **C.B.S.E. Sample Paper 2007.

Ans. Ethoxy ethions is anisothe in water because of everyon bonding, exygen of other can form hydrogen bonds with water molecules as

Q. 18. Butan-1-of has a bigher box ing point than diethy other

Ans. Butan-1-of has a bigher box ing point than diethy other

Butan-1-of has a bigher box ing point than diethy other

Ans. Butan-1-of has a bigher box ing point than diethy other molecules. Therefore, t exists as associated molecules and there are no housing point is high but and other diethy days are the second of the second o

detayl effect does not show an insecretion by intermolecular hydrogen nonding. Hence its boiling point is low Q.14 (CH₂), (-O, CH₂ on reaction with HI gives (CH₂), (-I and CH₂—OH as the main products and not (CH₂) (-OH and CH₂-I).

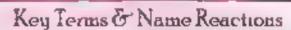
Ane. The reaction:

CH,
$$O$$
 OCH, $+$ HI $\xrightarrow{572\,\mathrm{K}}$ CH, 0 I + CH, OH CH,

gives 'CH₁ C I and CH₁OH as the main products and not (CH₁) COH and CH₂I. This is because the reaction occurs hi S₂ mechanism and the formation of products is governed by the stability of carboration formed from the reavage of C. O bond in the protonated ether. Since (cr) bury carbocation, 'CH₂, C' is more stable than methyl carbocation, CH, therefore the derivage of C. O gives a more stable carbocation. (CH₁, C') and methanol. Then include ion, C attacks this tort, butyl carbocation to form tert, butyl inclide

Q.15. Complete the reaction:

Same S R 2018)



- Esterification. The reaction of alcohols and carboxylic arms to the presence of conc. H.St., to from esters
- Hydrogenolysis. Catalytic hydrogenation is called hydrogenolysis.
- Hydroboration oxidation reduction.

e.g. $CH_1 \cap H \longrightarrow CH_1 \xrightarrow{A \otimes B_1 \cap H_2} CH_2 \cap H_3 \cap H_4 \cap H$

• Oxymercuration-demercuration reaction

$$eg = CH_{i} \cdot CH_{i} \cdot C = CH_{i} \xrightarrow{\text{Soligher}_{i}} \text{CH}_{i} CH_{i} \cdot C + CH_{i} \text{ necessary of so Markovnikov's rule} \\ CH_{i} = CH_{i} \cdot CH_$$

Dow's renotion

Reschig's pencess

$$2 \longrightarrow + 2HC + O_2 \xrightarrow{CuCl_2, PeCl_3} + H_2O \xrightarrow{SiO_2} \longrightarrow \bigcirc$$

Friedel Crafts alkylotion

Elbs persulphate oxidation.

p Cressi

Fries rearrangement

Reimer Tiemann resotion

2-Hydroxy benzoldchydd Salicyaddchyde

Carbon tetrachloride may also be used in place of chloroform.

Coupling reactions

p-Hydroxyoxa bensene (urange dye)

Williamson saynthesis

QUICK CHAPTER ROUND UP

Preparation of Alcohols

Hydrolysis of alkanes

Reduction of aidehydes/ketones.

Reduction of corboxytic ands/esters

$$\mathfrak{M}_{a}(a) \circ \mathfrak{l}^{\infty}H_{a} \stackrel{\mathsf{Nu.}}{\longrightarrow} \mathfrak{l}_{a} \stackrel{\mathsf{H}_{a}(b)}{\longrightarrow} \mathfrak{l}_{b} \circ \mathfrak{l}_{b} \circ \mathfrak{l}_{b} \circ H_{a} \circ H$$

· From Grignard reagent

From alkeuee bydrolysie

$$(CH_{a_1}C + CH_a + H_aO \longrightarrow CH_{a_2}C + OB$$

Hydroborauou-oxidation

anti-Markovnikov rule)

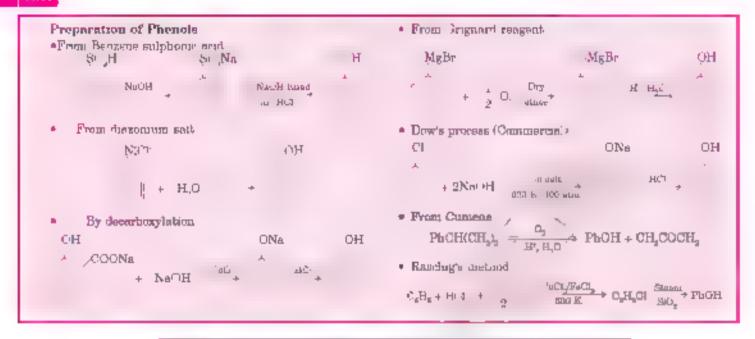
Oxymercuration-demonsuration.

$$H_{j}, \quad = c_{j}H_{j} \qquad \frac{H_{dr} \wedge \ker_{g}H_{j}\Gamma}{c_{j} N_{0}DH_{j}} + c_{j}H_{j}, \quad c_{j}H$$

Markovnikov's addicion reaction

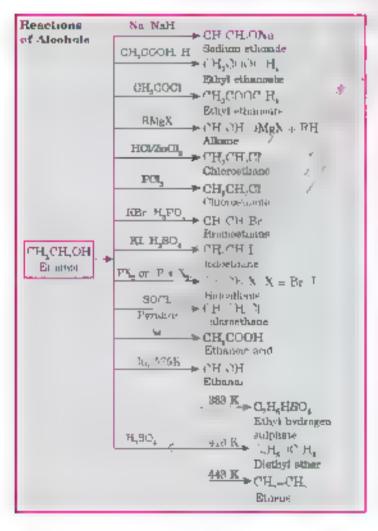
• Ozo process $CH_{i}-CH_{i}+CO+H_{i}\xrightarrow{bigh\ T.P}CH_{i}CHO\xrightarrow{H_{i}\ Ni}$

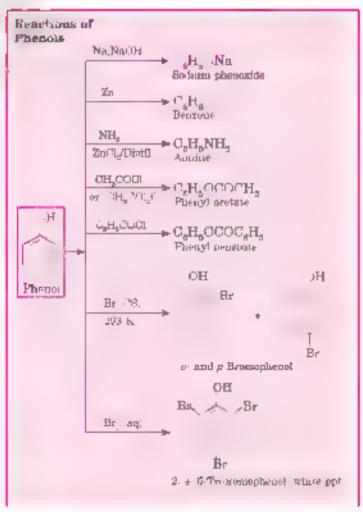
CH,CH .H

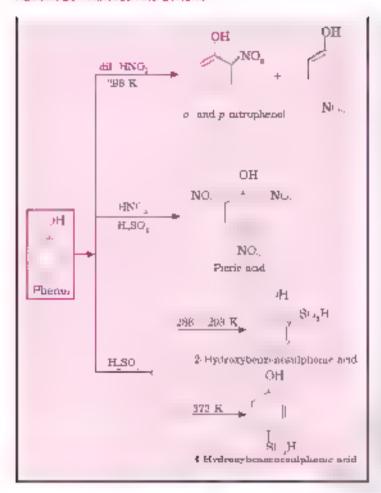


Alcohols are weaker acids than water Phenol is more acidic than ethyl alcohol

- Electron withdrawing groups NO_n CN, X increase acidic strength
- Electron dounting groups (-R, -NH_p, -OR) decrease neidic strength.







Ethers are called alkony alkanes.

- In alkyl any others, the products are always phenot and alkyl hande and never an anyl bande and alcohol.
- Dienv one such as dipheny ethers are not deaved by HI

Alkory group is o and p-directing group in electrophilic metabolishmen constrain-







NCERT

In-text Questions



Q.1. Classify the following as primary secondary and tectiony alreads to

Ans. Framery alcohol a Primary alcohol a Primary alcohol a Secondary alcohol a Secondary alcohol (or Tertiary alcohol

Q.2. Identify allylic alcohols in the above examples.

Ans. (4) and or are allylic alcohols.

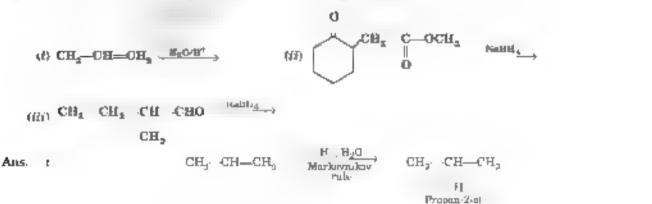
Q.S. Name the following compounds according to IUPAC system

Ans. Refer Solved Example 2 page 8.

Q.4. Show how are the following alcohols prepared by the reaction of a sustable Grigorard reagent on methanal?

Ans. (i) $GH_3 = CH^* + CH_2OH_3$. The enclosed part comes from mathematicand and the remaining part comes from the Engineen reagen-

Q.5. Write structures of the products of the following reactions:



HELP

NeBH, is a weak reducing agent and reduces the aldebynes and ketones and not the esters

- Q.6. Give structures of the products you would expect when each of the following alcohol reacts with a) $HCl-ZnCl_p$ (b) HBr and p: $SOCl_p$
 - 3" Butan-1-or .if) 2-Methyllicitan-2-ol
- Ans. a HCl—ZaCl₂ It is Lucas reagent Butan 1-or does not react wit HCl—ZaCl₂ at room temperature However surbiday appears only upon heating

3- Bruibo-3-bie flythutabe

$$\begin{array}{ccc} \mathsf{CH_3CH_2CH_2CH_2OH} & \xrightarrow{\mathsf{BCI}} & \mathsf{CH_3} & \mathsf{H_0CH_2CH_2OH} \\ \mathsf{Butters} & \mathsf{ol} \end{array}$$

But 2-methylbutan 2-or 3" reacts at room temperature going furbidity immediately

b HRr. Buth alcohola react with HRr to give corresponding alkyl broundes.

ርዜ, ንዚ.ንዚ.ዮዜ.፫ ዘ 🚁 🖰 🧸 - እነዚ.ዮዚ.ዮዜ.ዮዜ ክስ

c SOCl_a. Buth alumals react to give corresponding alkyl chlorides.

Q.7 Predict the major product of acid catalysed dehydration of (1) 1 methyl cyclohexanol and (ii) butum 1-01

Ans. And carrysed dehydration of 1 methylcyclobexanol gives two products I and II. But product I is highly substituted and bears, accepting to Saytasif rule, is inquir product.

The and-catalysed dehydration of basen 1:01 produces but-2:end as he more product and but 1:end as the monor product. This is because dehydration of a comous occurs through as a formation of carbocation intermediates. During the renation it first forms 1°-carbocation. I which undergoes I 2-hydride shuft 1 form 3 carbocation. II This men losses a proton to form more stable out-4-end united of our 1-end. This is because but-2-one is more stable and according to Saytzaff rule is preferably formed.

Q.8. Ortho and para nitrophonols are more acidic than phenol. Draw the resonance structures of the corresponding phenomic lans.

Ans. The responding structures of phenoxide one and ortho and para cubsuphenoxide one are

Resonance structures if a-actro phenicade aid-

Resonance structures of p-astrophenomids and

It is clear from the above structures that due to I effect of N^p , group, ϕ and ρ -astrophenomic ions are more stable because they have additional resonance structures N^p and N^p , then phenomics ion. Hence ϕ and ρ -introphenois are more aridio than phenoi

Q.9. Write the equations involved in the following reactions .

(f) Reimer Tiemanu reaction

(f) Kulbe's exaction

Ans. Refer special reactions of phenols (s, 2 and (ii, 1 (Text Book page 40-41)

Q.10. Write the reactions of Williamson synthesis of z ethoxy-8-methylpentone starting from ethanol and 3-methylpenton-2-of

Q.11 Which of the following is an appropriate set of reactants for the preparation of a methoxy-4-ultrobensene and why?

Ans. Chemically both sets are equally probable. In set A the in group, a activated by the electron withdrawing effect of NO_2 group. Therefore, nucleophilic attack of ${}^{\circ}H_{a^{\circ}}$ by follower by elimination of NaBr gives the desired ether

Stabilized by resonance

Step 2.

In set B nucleophilic attack of 4 introphenioide on on methyl bromide gives the desired product

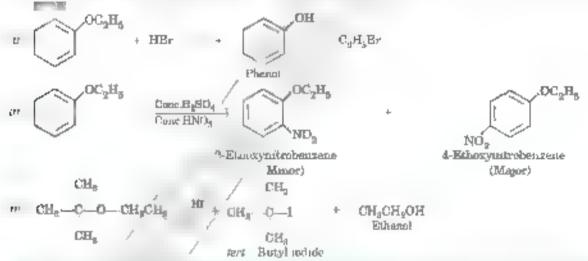
NO₃ + CH₆ D_{Br}
$$B_{N^2}$$
 OCH,

Sodium 4-ostropheomide no

. Methody 4-outrobensene

Q.12. Predict the products of the following reactions

Both the alkyl groups attached to C atom are primary and therefore attack of Br ion coours on the smaller methyl



When me of the gro-ps or ansymmetrical ether is tertiary, then the hande formed is tertiary halide.

NCERT

Textbook Exercises





Q.3. In) Draw the structures of all isometric alcohols of molecular formula $C_pB_{1p}O$ and give their ICPAC names. (6. Cassify the isomers of alcohols in question $\delta(a)$ as primary, secondary and tertiary alcohols.

Aus. Refer Solved Example 1 (Page 8)

CH₂Ch

Q.4 Explain why proposed has higher boiling point then that of the hydrocarbon, butane?

Ans. The moterales of proposol are seld together by otermolecule, sydrogen broiding while butene molecules have any week van der Wante forces of attraction. Since hydrogen bonds are stronger than van der Wante forces, therefore, proposol has higher brilling point than butane.

Q.5. Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.

Ans. Alcohols can form hydrogen bunds with water and break the hydrogen bunds existing between water unlecules. Hence, they are soluble to water.

On the other hand, hydrocarbona cannot form hydrogen bonds with water moscoules and hence are maduable to water

Q.6. What is meant by hydroboration-oxidation reaction? Illustrate it with an example.

Ans. The addition of discreme to alkenes to form trially bornnes followed by their oxidation with alkenne hydrogen peroxide to form electron electron electron.

For example.

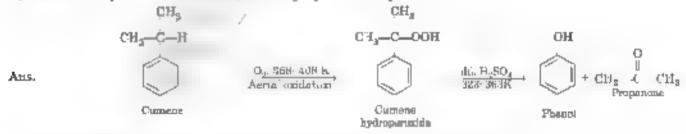
Q.7 Give the structures and IUPAC names of monohydric phenols of mulceular formula, C.H.O.

Ans. Three isomers are possible

Q.8. While separating a maxture of ortho and pure marophenols by steam distillation, name the isomer which will be steam volatile. Give reason.

Ans. o Narrephenol is steam volatile due to chempton because of intramolecular hydrogen bonding. In the other band, p-introphenol is not steam volatile because of intermolecular hydrogen bonding. Hence o-microphenol can be separated from p-introphenol by steam distillation.

Q.9. Give the equations of reactions for the preparation of phenol from rumene.



Q.10. Write chemical reaction for the preparation of phenol from chlorobenzone.

ALCOHOLS, PHENOLS AND ETHERS

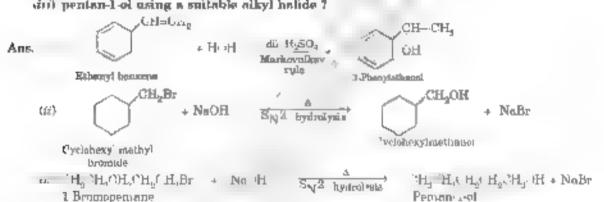
Q.1. Write the mechanism of hydration of ethere to yield ethanol.

Ans. It is an example of electrophilic addition. The water molecule with a little potenty is not in a position to give H. for the mittel accept. Therefore it is on acid colorysed reaction. The Hill of the each military stracks the attend to form corbocation which then takes up an alectron pair from HoO molecule

- Q.12. You are given between conc. H_iSO_s and NaOH. Write the equations for the preparation of phenol using these reagents.
- Ans. Catta Com Hatta a NaOH di HC C.H.OH $C_6H_5SO_3H$ C H_sON_B Puge 574 K Benzene Betweineso phintucional Bodraio phenistile

Q.18. Show how will you synthesize

- (f) 1-phenylethanol from a suitable alkene,
- (f) cyclohexylmethanol using an alkyl hande by an S₂ reaction,
- siri) pentan-1-ol using a suitable alkyl halide ?



Q.14. Give two reactions that show the ocalic nature of phenol. Compare acidity of phenol with that of echanol. Ans. The reactions showing andic character of phenol are

. Reaction with sodium. Phenot reacts with sodium to give H, gas

Snaum phenoxide

. Reaction with NaOH. Phenol dissolves in NaOH to give sodium phenoxide and water

Sodium phenoude

Phenon is more acadic than ethanon because of more resonance stebuazed structures of phenoxide Refer Text Book page 38-34.

Q.15. Explain why is ortho nitrophonoi more acidic than ortho methoxyphenol?

Ans. Due to strong R and I effect of NO₂ group electron density in O—H and decreases and hence the loss of a proton becomes easy

I effect decreases electron density to the O—H bond and makes the release of proton easy R effect results in +ve charge on C atom and hence facilitates the release of a proton

Moreover the o-catrophenoxide formed after the loss of a proton is stabilized by resonance.

Resonance stantifized

o-introphenoside on a stabilized by resonance and hence o-introphenous a stronger and. On the other hand, due to +R effect of the -4 1°H, group the electron density in the 15-H is not increases and this indices the case of proton differen-

Furthermore, after the loss of proton a methogyphenionde ion ich is destabilized by resonance.

The two negative charges rape each other and therefore descabilize the o-meleoxyphenoxide ion. Thus, c-mitrophenol is more andic than o-methoxyphenol.

Q.16 Explain how does the OH group attached to a carbon of beuzene ring activate it towards electrophilic substitution?

Ans. Phenol is a resonance hybrid of the following structures

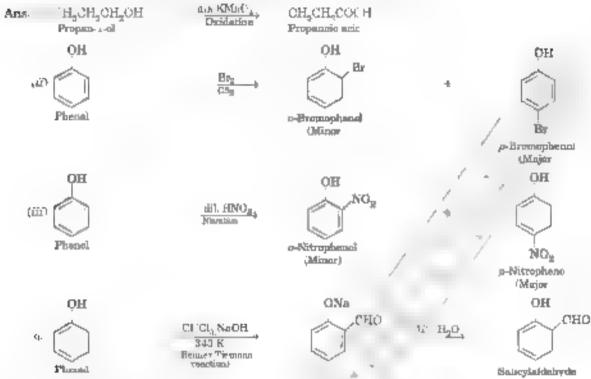
o-and p-positions are electron rich sites

As a result of +R effect of the OH group, he electron density in the henzene ring increases and hereby facilitating he attack of the electropials. Hence presence of iH group activates the centering inwards electropials substitution reaction. This because the iOH group is an activating group, these reactions occur at a faster rate than reactions of binaries self. Further it is clear from the resonating structures, the electron density is relatively higher at a and p-positions and herefore electrophilic substitution occurs preferentially at o-and p-positions. Thus the iOH group is ortho-para directing and therefore incoming group comes at ortho or para position.

ALCOHOLS, PHENOLS AND ETHERS

Q.17. Give equations of the following reactions:

- (i) Oxidation of propen-1-of with alkaline KMaO, solution.
- (i) Browing in CS, with phenot
- (iii) Dilula HNO, with phenol.
- (iv) Treating phenol with chioroform in presence of aqueous NaOH.



Q.18. Explain the following with an example:

(i) kalbe's reaction

- (f) Reimer-Tiemenn reaction
- (iii) Williamson ether synthesis
- (iv) Unsymmetrical other

Ans. (i) Refer special reactions of phenot, reaction 1 Test Book Page 40.

- (ii) Refer special reactions of phenols, reaction 2 (Test Book Page 41)
- u. Refer general methods of preparation of other maction 2. Text Book Page 80:
- . If the alkyl or anyl groups attached to the O-asson of the others are different, ethers are called anayommetrical ethers. For example

CH_a∩C,H_b Ethylmethyl ether `H₃(N₁₉H₃ Methylpheoyl other

Q.19 Write mechanism of acid delighration of ethanol to yield ethano-

Ans. Refer Text Book Page 20

Q.20. How are the following conversions carried out?

- (i) Propens → Propus-it-ul
- (i) Benzyl chloride + Benzyl alcohol
- žir) Ethyl magnesiom chlori le + Propon 1-ol
- tiv) Methyl mognesium brounds 📉 2 Methylpropau-2-ol

- Q.21. Name the reagents used in the following reactions:
 - (f) Oxidenou of a primary alcohol to carboxylic acid
 - (i) Oxidetion of a primary alcohol to aldehyde
 - (iii) Brommation of phenol to 2,4,8-tribromophenol
 - (lv) Benzyl alcohol to benzuic sold
 - v) Dehydrotion of propan-2-of to propene
- (cr) Butan-2-one to butan-2-of
- Ans. (i) Anddied K₂Cr₂O₇ or KMnO₄
 - Fyridingum chlorochromate PCA in 'H. A. or Pyridingum dichromate (PIA or 'H. A.
 - и Aqueros Br., в.е., Br./H.O
 - Andried or atkaline KMas, followed by hydrotysis with di. H.S.,
 - (p) Cone H,SO, at 443 K
 - (oi) NaBH, or NvH,

Q.22. Give reason for the higher builing point of ethanol in comparison to methoxymethane.

Ans. The bothow point of ethanoi is higher than methody notheric because of the presence of scrong intermolecular hydrogen bonding between athenoi molecules. Because of hydrogen bending energy has to be supplied to overcome the forces of attraction between molecules and therefore, builting point is high

However, no such hydrogen bonding exists in methodymethene

Q.23. Give IUPAC names of the following ethers:

the CH,CH,CH,OCH,

- 1 Methoxypropage $m{Q}.24$ Write the names of reagents and equations for the proparation of the following others by Williamson's synthesis:
 - (f) 1-Proporvoronana

- (fi) Ethoxybenzene
- hil) 2 Methoxy-2-methylpropage

I-Methoxy-2-methylpropane

(iii) 1 methorvethane

Ans. Refer Solved Example 17 (Page 67)

- ${f Q.25}.$ Mustrate with examples the limitations of Wikiamean synthesis for the preparation of certain types of ethers. Ans. Refer Text Book Page 60
- $\mathbf{Q}.26$. How is 1 propoxypropane synthesized from propon 1-ol? Write mechanism of this reaction.

Ans. With amoon synthesis
$$CH_3CH_2CH_2OH$$
 $\stackrel{P}{Br_2} \rightarrow CL_3CH_2CH_2Br$ $\leftarrow J_3PO_3$ $\downarrow Dirac appropriate $\stackrel{P}{CH_3CH_2CH_3OH}$ $\stackrel{P}{\sim} H_1CH_2CH_2OH$ $\stackrel{P}{\sim} H_2CH_2CH_3OH$ $\stackrel{P}{\sim} H_2CH_2CH_3OH$ $\stackrel{P}{\sim} H_2CH_2CH_3OH$ $\stackrel{P}{\sim} H_2CH_2CH_3OH$ $\stackrel{P}{\sim} H_2CH_3OH$ $\stackrel{P}{\sim} H_2CH_3$$

It can also be prepared by debyttration of propers that with cond H.SO, at 413 K.

$$2\mathrm{CH_3CH_2CH_2OH} \qquad \frac{\mathrm{H}}{413\ \mathrm{K}} \rightarrow \quad \mathrm{CH_3CH_2CH_2OCH_2CH_2CH_3}$$

$$\qquad \qquad \star \text{ Projects projecte}$$

Q.27. Preparation of others by acid dehydration of secondary or tertiary alcohols is not a suitable method. Give reason.

Ans. And retaiveed deliveration of 1° alcohole to ethers takes place by S_n2 reaction involving aucleophilic attack by the sucohol molecule on she protoned alcohol molecule as

$$CH_{2}CH_{2}CH_{3}OH + CH_{2}CH_{2}CH_{2} CH_{2} CH_{2} CH_{2} CH_{3} CH_{3} CH_{3} CH_{4} CH_{5} CH_{5}$$

However under these conditions, 2° and 3° alcohols give a kenes rather than ethers. This is because of the stems hindrance, nucleophilic strack by the alcohol on the protonated alcohol, molecule uses not take place. Instead of this, the protonated 2° and 3° alcohols uses a molecule of water to form stable 2° and 3° carbonations. These carbonations then prefer to use a proton to form atkanes rather, has undergoing nucleophilic attack by alcohol molecule. In form others

Similarly, 3" alcohols give alkenes

Q.28. Write the equation of the reaction of hydrogen radide with

(f) 1-proporypropane, (i) methoxybenzene and (iii) benzyl ethyl ether-

Q.29 Explain the fact that in any alkyl others i) the a keey group activates the bearens ring towards electrophilic substitution and in it directs the incoming substituents to ortho and para position in bearens ring.

Ans. The alkoxy group increases the electron density on the benzeue may son therefore, solvates the aromano may cowards electrophilic substitution reaction as given below

As as clear structures III. IV and V show high electron density as ortho and para positions and therefore, direct the incoming substituents to a and p-position in the benzene ring.

Q.30. Write mechanism of the reaction of HI with methoxymethane.

Ans. Step 1. Ether molecule gets protonated

Step 2. The protocoled ether undergoes $S_a k$ attack by Γ and

If HI is at excess, the methanol formed in step 3 is east converted into metay' made as

Q35. Write equations of the following reactions.

- (f) Friedel Crafts reaction alkylation of anisote
- (i) Nitration of anisole
- (iii) Beomination of emisole in ethonoic seid medium
- (iv) Friedel Craft's acetylation of aulsole

Ans. Refer ring substitution reactions of aromatic ribers. Test Book Page 73-74

Q.32. Show how would you synthesize the following alcohols from appropriate alkenes?

Ans. The aikenes for symbousing the econols can be predicted by first delighrating the elcohol to give single alkane or a mixture of alkenes. If a mixture of alkenes is possible, it is find out which alkene gives the desired alcohol. It must be remembered that each catalysed addition of H.O. to alkenes occurs in accordance with Markovinkov a rule.

The desired alcohol can be obtained by addition of $H_{\nu}O$ to either of these.

ALCOHOLS, PHENOLS AND ETHERS

Addition of water in the presence of an and gives the desired elcohol

However pent-2-ene will give two products

Addition of H_sO to either of these alkenes gives the desired alcohol

2-Cyclohetsyl

but-2-eno

Q.33. When 2-methylhutan-2-or is treated with HHr following reaction takes pince

2-Cyclohercylldene

butane

2-Cyclohecyl

hat: 1-ene

Give a mechanism for this reaction.

Ans. Alcohol gets protonned

2-Cyclobexyl

buton 2-of

4. Protonated alcohol mass H,O molecule to form 2" carbocation

(iii) 1, 2-hydride shift of 2-carbocation gives more stable 5' carbocation

(co) Nucleophilic attack by Br. ion gives alkyl halids





NCERT

Exemplar Problems



Subjective Questions

Objection Questions from Ex. implier Problems are extenn Compet tion File page 131

--- III. Short Receiver Type Questions ---



Q.2. Write the Il PAC name of the compound given below.

Ans. 8 Methylpent-2-ene-1 2-diol

Q.3. Name the factors responsible for the solubility of alcohols in water

Ans. The factors responsible for the solubility of alcohols in water are:

Hydrogen bonding

βıze of alkyl or aryl group.

Q.4. What is denotured alcohol?

Ans. It is 95% ethyl ricatal. To avoid minute of alcohol for drinking it is made unfit by naming some copper sulphate. and synding in it. This is called densitized alcohol.

Q.5. Suggest a reagent for the following conversion.

Ans. Pyridinum chlorochromate. $CrO_{\mu}G_{\nu}H_{\nu}N$ HCI

Q.6. Out of 2-cluoroethanol and ethanol which is more acidic and why ?

Ans. 2-Chloroethanol is more earlie because of I effect of chlumne stone

Q.7. Suggest a reagent for conversion of ethanol to ethanal.

Ann. Pyrtdinium chlorochromate, CrO, C, H, N HCl

Q.S. Suggest a reagent for conversion of ethanol to ethanore acid.

Ares. Any outdomy agent algo ecidated KMaO, oridated Roy Tak

Q.S. Out of o-nitrophenol and p-nitrophenol, which is more voictile 5 Explain.

Ans. Orthogetrophenol is more voletile because there is intramolecular hydrogen bonding in a-nitrophenol p-Nitrophenol has intermolecular hydrogen booding.

Q.10. Out of o-nitrophenol and o-cresol, which is more ocadic ?

Ana. o-Nitrophenol because mitro group is electron withdrawing group and it increases acidic strength.

Q.11. When phenol is treated with bromine water, white precipitate is obtained. Give the structure and the name of the compound formed

Ans.
$$OH$$

$$+ Br_{q_{1}}(aq)$$

$$+ Br$$

9 4 6-Tribromophenol

Q.12 Arrange the following compounds in increasing order of acidity and give a suitable explanamon. Phenol, o-nitrophenol, o-cresol

Aus. Increasing order of sculity o-Cresol < Phonol < o-Nitrophenot OH

In arcsol,
$$CH_5$$
, the electron donating group

($\cdot \mathrm{CH_2}$ gives electrons and inventify the charge on phenomele in and therefore makes it metable. Therefore, o-creat is less acidic than phenol. In o-nitrophenol, the electron withdrawing $\cdot \mathrm{NO_2}$, group withdraws electrons and disperses the $\cdot \mathrm{ve}$ charge and stabilizes the phenometer ion. Therefore o-introphenol is more acidic than phenol.

- Q.18. Alrehola react with active metals e.g. Na. K etc. to give corresponding alkonides. Write down the decreasing order of reactivity of section metal towards primary, secondary and tertiary alrehols.
- Ans. Decreasing order of reactivity of sodrum metal to 1° > 2° > 3°

Alcohole react with sodium metal to form alkesides and bydrogen is liberated

$$R_1 + A = H + N \alpha \qquad \rightarrow R \cup N \alpha + \frac{1}{2} H_2$$

The order of reactivity of alcohols is primary > secondary > tertiary. This can be explained on the basis of deavage of O—H cond. The alkyl groups are electron releasing groups (+I effect) and they increase the electron density around the unygen. As a result, the electrons of O—H bond cannot be withdrawn strongly towards oxygen and O—H remains strong. Therefore greater is the number of alkyl groups present, smaller will be reactivity of skrobol.

Q.14. What happens when benzene diazonium chloride is nested with water?

$$N_2$$
 CI OH

Ans. $+ H_2$ O Ween Planut

Q.15. Arrange the following compounds in decreasing order of acidity

$$\mathbf{H}_{\mathbf{U}}\mathbf{O}$$
, ROH, $\mathbf{H}\mathbf{U} = \mathbf{C}\mathbf{H}$

Ans. $H_2O > ROH > HC \Longrightarrow CH$

Q.16. Name the enzymes and write the reactions involved in the preparation of ethanol from sucrose by fermentation.

Ans. Invertage and symage

Q.17. How can propon-2-one be converted into terf-buty.

alcohol?

Ans.
$$CH_{3}$$
: $C \cdot CH_{3} + CH_{3}MgBr \xrightarrow{Dr_{2}}$ \rightarrow
 $CH_{3} \cdot CH_{3} + CH_{3}MgBr \xrightarrow{d^{2}} CH_{3} + CH_{3} - C - OH_{3}$
 $CH_{3} \cdot C \cdot OMgBr \xrightarrow{d^{2}} CH_{3} - C - OH_{3}$
 $CH_{3} \cdot CH_{3} \cdot CH_{3} + CH_{3} - C - OH_{3}$

Q.18. Write the structures of the isomers of recolors with molecular formula $C_4 H_{16} O$. Which of these exhibits optical activity ?

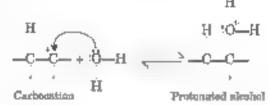
(ii) is optionally active

- Q.19. Explain why is OH group in phenols more strongly held as compared to OH group in alcohols.
- Ans. The OH group in phenol is more strongly held because of double bond character between C and O due to recomme
- Q.20. Explain why nucleophilic substitution reactions are not very common in phenols.
- Ans. in phenois, the OH group is activating group and increases the electron density at orthogoad para positions. Therefore, phenois undergo electrophilic substitution reactions and not nucleophilic substitution.
- Q.21 Preparation of acohols from alkenes involves the electrophilic attack on alkene carbon stom. Explain its mechanism.

Axs. (a) Alkenes get protonated by the electrophilic attack of $H_*\mathbb{C}^+$

$$C = C + H \xrightarrow{\dot{Q}} H \xrightarrow{\dot{\gamma}} -\dot{C} \xrightarrow{\dot{C}} + H^{\dagger}O$$
arbonston

b Nucleophile H₀O estacks the carbocation forming protonated alcohol.



.c) Loss of H* from oxygen deprotonation, to form alcohol.

Q.22. Explain why is O=C=O non-point while R=O=R is polar.

Ans. □=.\= □ molerute is inser so that the polarities of two
□=0 bonds get carrielled and the molecule is inser
Ethers have structures aimler to water and have angular
or bent structure. Therefore, the polarity of two R=0
groups does not get cancelled and these have not dipole
moment Thus, R=□-R is polar.

$$\begin{array}{ccc}
\overleftarrow{b} = c & \overrightarrow{b} & \overrightarrow{k} \\
\mu = 0 & & \ddots & \\
\end{array}$$

Q.28. Why is the reactivity of all the three classes of alcohols with cone. HCl and ZnCl₂ (Lucas reagent) different?

Ans. The electron combine with HCl to form protonated alcohol.

The positive charge on unygen weakens the C-O bond tenting to its cleavage.

The rate determining step in the above mechanism is it), which is a slow step reaction. The stability of carbocation will determine the reactivity of the reaction. Since the order of stability of carbocation is

pri. < sec. < tert. Hence the order of formation of alltyl balifie in the above reaction is pri. < sec. < tert

Q.24. Write steps to carry out the conversion of phenol to aspirin.

Q.25. Nitration is an example of aromatic electrophics substitution and its rate depends upon the group already present in the benzene ring. Out of benzene and phenol, which one is more easily nitrated and why?

Ans. Phenol is more easily nitrated than beauens. The presence of -OH group in phenol normales the electron density at ortho and para positions in benzene ring by +R effect. Since natration is an electrophilic substitution reaction it will be more reactive at position where the electron density is more

Q.26. In Kolbe's reaction, meteral of phenol, phenoxide ion is treated with carbon dioxide. Why?

Ans. Phenomic ion is more reactive than phenol towards electrophilic arometic substitution. There it undergoes electrophilic substitution with carbon diaxide which is a weak electrophile.

Q.27 Dipole moment of phenol is smaller than that of methanol. Why?

Ans. In phenol, C—O bond is less point due to electronwithdrawing effect of benzene ring. In methanol, C—O bond is more polar due to electron-releasing effect of CH, group. Therefore, phenol is less polar than methanol.

Q.28. Ethers can be prepared by Williamson synthesis in which an alkyl halide is reacted with sodium alkanide. Ditert-butyl other can't be prepared by this method. Explain.

Ans. In tert-butyl handes, elimination is favoured over substitution, and therefore, alkens is the only reaction product and other is not formed

Q.29. Why is the C—O—H bond angle in alcohols slightly less than the tetrahedral angle whereas the C—O—C bond angle in other is slightly greater?

Ans. The C—C—H bond angle in alcohols is slightly less than the tetrahedral angle 109.5°) because of larger repulsions between the ione pairs of electrons. For example in methanol, C—O—H bond angle is 108.9°

In others, the C—C—C bond angle is slightly greater than tetrahedrel angle. For example in dimethyl other. C—O—C bond angle is 1.1.7° The larger bond angle in others may be because of greater repulsions between bulker alkyl groups as compared to one H in alcohols.

Q.30. Explain why low molecular mass alcahols are soluble in water

Ans. The lower members of alcohols are highly soluble in water but the solubility decreases with morease in molecular weight. The solubility of lower alcohols in water is the to the formation of hydrogen bonds between alcohols and water molecules

ALCOHOLS, PHENDLS AND ETHERS

However, as the size of electric molecule increases, the alkyl group becomes targer and prevents the formation of hydrogen bands with water molecules and hence the solubility gues on decreasing with increase in length of carbon chain or molecular mass of alcohol.

- Q.81 Explain why p-nitrophenol is more seidle than phenol.
- Ans. The electron withdrawing group NO₂, withdraws electrons and disperses the negative charge. Therefore, NO₂ group stabilizes the phenoxide ion. Hence p-mirrophenol is more acidic than pheno)
- Q.82. Explain why alcohols and others of comparable molecular mass have different boiling points?
- Ans. Ethers have low polarity and as a result do not show any association by intermolecular hydrogen bonding. Therefore, ethers have low boiling points and lower than that of isomeric alcohols and aimost same as those of alkanes of comparable and equipment assess.

The sarge difference in builting points of alcohols and ethers is due to the presence of hydrogen bonding in alcohols.

Q38. The carbon-caygen bond in phonol is slightly stronger than that in methanol. Why?

Ans.C—C bond in phenol is stronger than that in methanol due to the fact that

- (i) In phenol, conjugation of ione pair of electrons on oxygen with aromatic ring casults in partial double bond character in earbon-oxygen bond
- (ii) In phenol, oxygen is bonded to a sp³ bybridised carbon atom while in methanol, it is bonded to a sp³ hybridised carbon atom. The bond formed between oxygen and sp³ bybridised carbon is more stable than that formed between oxygen and sp³ bybridised carbon.

Q.34. Arrange water, ethanol and phenol in increasing order of acidity and give reason for your answer.

Ans. Increasing order of modity is, ethanol < water < phenol. The phenoxide con obtained after the removal of a proton is stabilised by resonance whereas the ethanole can obtained after the removal of a proton is destablised by $+\Gamma$ effect of C_nH_n group. Therefore phenot is stronger and throughout.



Phenoxide for resonance stabilized

 $C_2H_6\ddot{O}$

Ethoside ner no тенопарис вкарійнастия

On the other hand athanol is weaker and than water because electron releasing $-C_2H_0$ group in ethanol increases the electron density on oxygen and hence the polarity of O—H bond in ethanol decreases. This results in the decreasing acidio strength. Hence acidio strength movemes in the order given above





MEMORY TEST



A. Say True or False

- 1. Ethers are more pular than moment alsohole.
- The boiling points of ethers are lower than those of somers alcohols
- Bond angle in dimethyl ether is more than in water
- Sodium ethoride can be prepared by the reaction of ethanol with aqueous acdium hydroxide.
- terri-budyi alcohol is toors enhabte at wister their n-budyi alcohol.
- 6. ra-methoxyphenol is a weaker and than phenoi
- 7 2. 4-dimitrophenol is less audio than phanol.
- Resutivity of ethanol is less with sodium than that of asspropyi electrol.
- 9. Alcohola are stronger ande than water
- Primary alcohols undergo dehydration more easily than secondary and tertiary alcohols.
- 1 Phonols turn blue litmus red.
- Primary similais un dehydrogenation give aldebydea
- Phenetole reacts with HI at 373 K to give ethanol and adobeozene.
- Acetone reacts with methyl magnesium bromide followed by hydrolysis to give secondary sicohols.
- Reactivity of belogen soids towards ethers follows the sequence

HI > HBr > HCI

B. Complete the missing links

- 1. Dehydration of ethyl elcohol with cone, H_2SO_4 at 415 K gives
- 2. Lower alcohols are highly soluble to water due to
- 3. 100% pure ethanol is called
- Terhany alcohol when passed over heated expper at 573K gives
- Amongst the three momens of astrophenol the one that is least writible in water is
- In the formation of salecylic acid by Reimer Tiemann reaction, phenolic bested with presence of NaCH
- 7. An enzyme which can convert glocose acts ethanol is
- B. Reaction of phenal with in the presence of aqueous Nath is called Schotten Baumann reaction
- Orthorough personal cannot be reparated by distribution.
- Phenol forms coloured complexes with neutral.
- Absolute alcohol can be prepared from rectified spirit by distribution.
- The lowest molecular mass sleebel which is optically active.

48. The main product obtained when sodium phenomes is treated with CO₀ at 400 K under 4-7 atm. pressure is



$$+\operatorname{Br}_{q}(aq) \longrightarrow$$

Choose the correct alternative

- 1 o-Nitrophonol has lower/higher pK, value than montrophenol
- C₆H₆OH is weaker/stronger and than O₈H₁₁OH
- 3. Water is weaker/stronger acid than ethanol
- Ketones are reduced to 1°/5° alcohole.
- 5. Phenol has smallerflurger dipole anguent than methanol.
- 6. Beazene-1, 2, 5-trial is called hydrogramottpyrigation
- Onlines reacts with Graganeti reagent to form premory secondary simbol.
- Cumene an semai and attou and on subsequent hydrolysis gives phenotiphenetice
- Butan-2-of has higher/lower boiling point than butan-1-of.
- Ethanol on treatment with cone H₂SO₄ at 448 K gives either either whose
- Picrio and is obtained by beating phenol in the presence of cone H₂SO₂ with cone HNO₂ cane HNO₂.
- Treatment of endium phenomide with 30, at 400 K under
 a pressure of 4-7 acm followed by acid-fication gives
 solicyhe acid-ienticyhldehyde.

Answers

Quick

MEMORY TEST



A. Say True or False

- L. Pause S. True S. True
- Folse. Ethanol is weaker and then water and cherefore it does not react with aqueous NaOH to form and con exhauste.
- 5. True. Salubility increases with branching.
- False. Due to -1 effect of methody group at m-position.
 m-methoxy phenol is a stronger acid than phenol.
- 7. Pruse
- 6. Page
- 9. Palse
- 10 Felos

- 11. True
- 12. True
- 18. False. It gives phenol and ethyl indide
- 14. False. CH_g 4. \Rightarrow CH_g $^{\text{CH}_2\text{MyBr}}_{\circ}$ \Rightarrow CH_g $^{\text{CH}_3}$ $^{\text{CH}_3}_{\circ}$ CH_g $^{\text{CH}_3}$

cert-Butyl alcohol

18. True

B. Complete the missing links

diethyl ether 2. hydrogen bonding

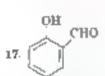
- 3. absolute alcohol 4. aikenes
- 5. o-astropheuo.

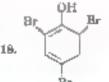
- 6. CCI₄
- 7. zymasa
- 8. benzoyl chlorade

- 9. eteam
- 10. ferric chioride 11. exectropic
 - areomob

ΟF

- 12. Butan-2-ol
- 18. aslicyhe seid
- 14 (), CH₂I
- 15. CH₃C=CH₂+ CH₄OH CH₂
- **16.** (СН₈СН₄)₀О





19. (CH_{a/a}CO + H_a 20. Za. ZaO

C Choose the correct alternative

- L. lower
- 2. abrouger
- S. stronger

- 4. 2"
- 5. smaller
- R. hydroxy quinol

- 7. primary
- 8. phenot
- 9. lower

- 10. ethece
- 11. cone-HNO,
- 12. salarylic neid



Higher Order Thinking Sk. 5



QUESTIONS WITH ANSWERS

Acid-catalysed debydration of terf-botanol is faster than that of n-b utanol. Explain.

Ans. And conclused debydention of alcohole occurs through the formation of carboration intermediate as

Since t-butyl carbocation 3^n is more stable than n-butyl carbocation 1^n , therefore, and-catalysed dehydration of t-butanol takes place faster than that of n-butanol

2. Hydration of 8-phenyl-1-butene with dil H₂SO₄ is not a satisfactory method for preparing 8-phenyl-2-butanol because 2-phenyl-2-butanol is obtained instead. Explain.

Ans. Hydration form 2" carbocation which undergoes a aydride harft to statute benzylic carbocation.

$$H_0C=CH$$
 CH_0 $\xrightarrow{B^*}$ H_0C CH_0 $\xrightarrow{B^*}$ H_0C CH_0 $\xrightarrow{C^*}$ C^* CH_0 $\xrightarrow{B^*}$ H_0C CH_0 H_0C CH_0 H_0C CH_0 H_0C CH_0 H_0C CH_0 H_0C

3 Give the product and show the steps in (i) the hydration of cyclobatylethene in dil. H_2SO_{i} , (ii) dehydration of cyclobatylearbinol.

Ans. • In the reaction, the addition of H* 42 ** gives a 2° cartecation, which reacranges by ring expansion. Finally, 4 gives 2-metaylcyclopentages.

This reaction results in the expansion of four membered to a five membered ring

Cyclobucylearbuiot

Сусторевлене

4 Arrange the following alcohols in the increasing order of reactivity with HBr:

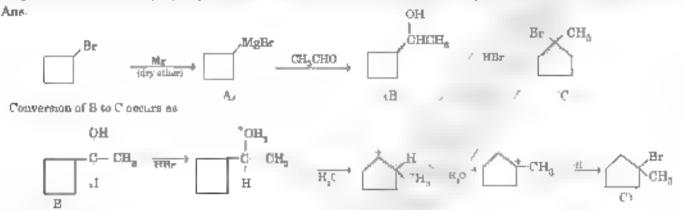
 $C_{\mathbf{g}}\mathbf{H}_{\mathbf{g}}\mathbf{C}\mathbf{H}_{\mathbf{g}}\mathbf{O}\mathbf{H},\ (C_{\mathbf{g}}\mathbf{H}_{\mathbf{g}})_{\mathbf{g}}\mathbf{C}\mathbf{H}\mathbf{O}\mathbf{H},\ (C_{\mathbf{g}}\mathbf{H}_{\mathbf{g}}\|_{\mathbf{g}}\mathbf{C}\mathbf{O}\mathbf{H},\ \mathbf{p}-\mathbf{C}\|\|C_{\mathbf{g}}\mathbf{H}_{\mathbf{g}}\mathbf{C}\mathbf{H},\mathbf{O}\mathbf{H},\ \mathbf{p}-\mathbf{NO},C_{\mathbf{g}}\mathbf{H}_{\mathbf{g}}\mathbf{C}\mathbf{H}_{\mathbf{g}}\mathbf{O}\mathbf{H}$

Ans. $p \cdot NO_n C_n H_n \cap H_n O H$

Show steps for the conversion of ethene to divinyl ether. Ans.

2. 2. linksorodiethyl ether

6. Cyclobutyl brounde on treatment with magnesium andry ether forms an organometallic A. The organo-metallic reacts with ethanal to give an alcohol B after node acid. Scotline. Prolonged treatment of accohol B with an equivalent amount of HBr gives 1-brown 1-methyl cyclopentane C. With the structures of A. B and explain bow C is obtained from B.



7 Explain why dehydration of alcohols to form alkenes is always corried out with cone. B_2SO_4 and not with cone. BCI or BC

Ans. Dehydration of alcohols, a alkanes occurs through the firmation of carbocotion intermediate. If HCl is used then chloride.

Cl. not being a good uncleophile with result into substitution resolves forming alkyl channels.

However of H_3SO_4 is used, when the bisulphate HSO_4 can using very weak nucleophile council result into substitution reaction. Rather the carboration loses a proton to form elimination product alkene. On the other hand, court HNO_3 also cannot be used because it is a strong contising agent and will preference by result into the endation of alcohole to aldebydes, ketones in randoxylin ands. Thus the dehydration of alcohole to form alkenes is a ways carried out with such strong acids H_3SO_4 . H.PO $_4$ etc. which have non-nucleophilic amons

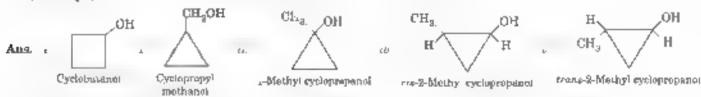
8 Alcohols donot react with NaBr but when $H_2\mathrm{SO}_4$ is added they form alkyl bromides. Explain

Actuargh Br' to a strong nucleoptide vet OH' being a strong base is a very poor maving group. Therefore Br' cannot displace OH' from ROH to form RBr Hones, alcohols donot react with NaBr

However, when $H_sSt_{\frac{1}{2}}$ is added, protonation of alcohols takes place and A^*H group gets converted to $A^*H_0^*$ Since water as a weak base, wherefore, A^* is a good leaving group. Hence, B^* can displace H_0O from protonated alcohol to form RBr.

$$R = OH + H^{\circ} \longrightarrow ROH_0^+$$
 $Protonated alrohol$
 $Br + ROH_0^+ \rightarrow RBr + H_0^-O$
Strong audeophile Good tenving group

9. Cyclic (,H,OR has five isomers. Write their structure and names.



 Neopenty: alcohol reacts with concentrated HBr to give 2-bromo-2-methylbutane. Write the mechanism for the formation of this product.



Ans.
$$CH_3$$
 CH_3 CH_4 CH_5 CH_6 CH

A methyl shift changes 1° carbocation to a stable 5° carbocation.

.1. Write three carbonyl compounds which may be used to menure

Ans. It can be prepared from an aidebyde, carboxylic and end ester by reduction such LiAIH, H.O.

.2. An ether A) $C_4H_{14}O$ when heated with excess of hot cone. HI produced two alkyl halides which on hydrolysis form compounds (B) and (C). Oxidation of (B) gave an acid (D) whereas oxidation of (C) gave a ketone E). Deduce the structural formulae of A_{15} (B), (C), D) and (E).

Ans. CH₂CH₃—O—CHCH₂CH₃
$$\xrightarrow{Hi}$$
 CH₃CH₂I + CH₃—CHCH₃CH₃

2. Ethoxy but one

A₁

H₂ H₃ H₄ H

CH₃ CH₄

OH

CH₃

CH₄

A = CH₂CH₂OCHCH₂CH₈ B = CH₃CH₄. H

CH₅ CH₄ CH₅ D = H₄ COPH

CH₄

A = CH₂CH₂OCHCH₂CH₈ B = CH₃CH₄. H

CH₅ CH₄ CH₅ D = H₄ COPH

CH₄

A = CH₂CH₂OCHCH₂CH₈ B = CH₃CH₄. H

CH₅ CH₅ CH₅ D = H₄ COPH

CH₅

CH₆

A = CH₂CH₂OCHCH₂CH₈ B = CH₃CH₄. H

CH₅ CH₅ CH₅

CH₆

A = CH₅CH₂CH₅CH₅ B = CH₃CH₄. H

CH₅ CH₅

CH₆

CH₆

A = CH₅CH₅CH₅CH₅ B = CH₃CH₅CH₅ A CH₅CH₅

CH₆

CH₆

A = CH₅CH₅CH₅CH₅ B = CH₃CH₅CH₅ A CH₅CH₅

CH₆

CH₆

A = CH₅CH₅CH₅CH₅ B = CH₃CH₅CH₅ A CH₅CH₅

CH₆

CH₆

A = CH₅CH₅CH₅CH₅ B = CH₃CH₅CH₅

CH₆

A = CH₅CH₅CH₅CH₅ B = CH₃CH₅CH₅

CH₆

CH₆

A = CH₅CH₅CH₅CH₅

CH₆

A = CH₆CH₅CH₅CH₅

CH₆

A = CH₆CH₅CH₅

CH₆

A = CH₆CH₅CH₅

CH₆

A = CH₆CH₅CH₅

CH₆

A = CH₆CH₆CH₆

A = CH₆CH₆CH₆CH₆

A = CH₆CH₆CH₆

A = CH₆CH₆CH₆

A = CH₆CH₆CH₆CH₆

A = CH₆CH

48. An organic compound A (C_3H_0O) reacts with sodium to form a compound B with the evolution of H_3 and gives a yellow compound C when treated with rodine and NnOH. When heated with cone. H_2SO at 413 K, it gives a compound D (C_4H_0O) which on treatment with cone. HI at 878 K gives E. D is also obtained when B is heated with E. Identify A, B, C, D and E and write equations for the reactions involved.

.4. Write the autermediate steps for each of the following reactions

is The odd box of \mathbb{H}^* to the double boxed takes place in accordance with Markovonkov's rule to form more stable carbocation I. Nucleophius attack by OH group on I gives the eyether product (II which readily loses a proton to form the final product III.

15. Complete the following reactions

$$b = 0 + i^{2}H_{3}h_{3}CHMgBr \qquad \Rightarrow CH=CH_{2}$$

$$c = CH + CH_{3} + CH + CH_{2}$$

$$c = CH + CH_{3} + CH + CH_{2}$$

10. A compound $D(C_gH_{10}O)$ upon treatment with alkaline satution of iodine gives a vellow precipitate. The filtrate on a cidification gives a white solid $E(C_gH_gO_g)$. Write the structures of D and E and explain the formation of E. Ans. Since compound $E = C_gH_{10}O$ upon creatment with a kaline solution of C_g gives yellow put successor D may be either

The unlection formula of Dauggesta it to be 1 phenyl estimate. C.H., CH CH.,

OH

The resolution may be explained as



Revision Exercises

Very Shart Resear Questions

corming a mort



- What is the order of reactivity of 1° 2° and 3° alcohols with sodium metri?
- Name the main product obtained when vapour of tert-butyl alcohol are passed over heated copper at 578 K.
- Phenot is bested with CHCl₂ and NnOH at 350 K. What
 is the product formed ⁹ Give the name of the reaction
- What happens when phenol is warmed with CO₂ in the presence of equeous NaOH? (Meghologo S.R. 90.5).
- What happens when phenol is oxidised?

(Uttorakhand S.B.2015)

- Write the structural formula of propens 1 2, 3- triol.
 Assum S B. 20, 6
- 8. Name the products obtained when amsole is treated with HI
- 9. Why is special care taken to dishi old samples of ether?
- Name the products obtained when anisole is treated with a mixture of conc. HNO_a and conc. H_aSO_a
- 11. Complete the reaction



12. Give the IUPAC name of the following compound CH₂ C = C CH₂OH (D.S.R.~7009).

CH, Br

- Draw the structural formula of 2-methylpropen-2-ol molerule
 LS B. 2012
- 14. Draw the structure of hex-1-en-3-of compound.

D.S.B. 2012, Tripura S.B. 2016)

Name the compound according to RUPAC rule
 OH



(Assum S.B. 2012)

- 16. Which of the following isomers is more volatile o-mitrophonol or p-maraphenol? D.S.B 2014*
- 17 Write the IUPAC name of

D S.B 1015

18. Complete the reaction

$$C_0H_3OC_0H_3 + 2HI$$
 373 K \Rightarrow

Hr SB "0.8

19. Give the IUPAC name of

 $C_0H_{6/2}$ $CHOC_2H_6$

(Jammu S B. 2018)

20. Give the IUPAC name of OCH,

CH_O_O_OH_OH_

(Jammu S.B. 2018)

CBSE QUESTIONS -

21 Write the structure of the molecule of a compound whose IUPAC name is 1 Phenylpropan-2-of

A15B (0)

23. How would you convert ethano) to athene?

(A.I.S.B. 2012, Hr.S.B. 2014)

23. Why is ±1- butan-2-of optically inactive?

D.S B "0/3 A / S B. 2013"

24. Write the ICPAC name of the given compound: HO.-CH.-CH.-CH.OH.

H₃ A.I.S.B. 2015 26. Write the IUPAC name of the following compound

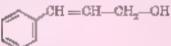
 $H_0C \rightarrow C \rightarrow CH_0$ OH CH_0Br ALER 3017

26. Write the TCPAC name of the following compound.

CH₃- a C-CH₃

ČH, A.1.8.B. 2017

27. Write the IDPAC name of the following compound:



A/S.B 2017

 Write she RPAC name of she following: "H₁

CH₃— Ç ÇH CH₃

"H"OH

A. I S. B 2018

MCQs from State Boards' Examinations

- 29. Dehydratase of tertucy alcohola with Ca at 575 gives
 - .c) Aidehydes
- (b) ketmes
- .c) A.kenes
- (d) None of hese (Hr S.R 2013
- 30. Molecular formula of ethers is
 - $a) C_{n}H_{2n+2}OH$
- / (b) C,H,O
- .c) C.H.,...O
- (d) None of these

Hr 5 B 9014 9017

- 31 Wilhamson's synthesis is an example of
 - Nucleophilic substitution reaction
 - b Nucleonhife addition
 - c Electrophilic substitution
 - o' None of the above

Hr S.B 3014

- 32. Reaction used for the preparation of ethers is
 - c) Remer-Tiemann reaction
 - 5 Williamson's synthesis
 - a) Wurte reaction
 - d) Centizzaro reaction

(HPS.B 2014

- The test cased to distinguish alcohols from one another is known as
 - a) Haisberg's test
- (b 2, 4-DNP test
- c) Iodoferm test
- (d) Lucas Lest

HPS.B. 2014

The RYPAC name of CH₂OH or

снон сн,он

fu, Propana 1 3-diol

7b, Propana 1, 2-dioi

(c) Propage 1 9, 8-thou

(d) Glycerol

Micoram S.B (615)

35. Ethers on hydrolysis give

(a) carbonylic and

45 Membel

e- ester (d) ketone

(Nogaland S.B 2018)

36. Which of the following has highest bothing point?

a Metherol

(b Etheopi

(e) Proposis 1-ni /

(d) Butan-1-ol

Hr S B 2018)

37 Which has highest value of pK,7

a. Phenol

to Ethrusol

(c) a-Missiphenol

(d) a-Cresol (Hr S B. 2016)

as. Which of the following is must acute?

(a) Benzyl alcohol

(b) Cyclohexanor

(c. Phenol

(d) m-Chloropisenol

Hr S B 00.71

39. Phenole on reaction with come HNO₂ in the pressure of

cone H₂SO₂ gives

(a) a-nitrophenal (A)

(b. m-mitrophenol

re p-mitrophenol

rd: 2,4 0-truntrophenor

Nogaland S.B 2017)

40. Methanol and ethanol can be distinguished by using

a. Fehling's test

(b) Iodoform test

(c) Tollen's test

(d) Carbylamine test.

Mizoram S B. 2017)

41. The IUPAC name of the compound

СН₉—СН—СН—СН—СН₂—ОН 18

CI CH, CH,

to 9-Chloro-8.4-dimethyl-n-pentyl acciden-

2-Chloro-3.4-dimethylpentan-5-or

c: 4-Chloro-2,3-dumethylpentan-1-ol

d 2,8-Dimethyl a-chioropenian-1-ol Migorom S B 30.73

42. OH_CH_OH - cone H_SO_ A' A' will be:

a "Ha="Ha

√b f_aH_a ⊕H_a

(e) $(C_0H_0)_0O$

(d) OH, CH, CH, CH,

48. Which is weakest acid in the following?

n H, H ← CH,CH,OH /b TH_{sto}THOH (d)/CH_{sto}COH

Hr S B. 2018:

R- S B. 2018:

44. Williamson synthesis is used to prepare.

a Alcohol

(в, Апиле

'c, Ketone

(d Ether

Hr S.B. 2018)

OCH, 45. In the reaction + HI

A and H are

'a, CaHal, CHaOH

(b) CaHaOH, CHaI

(c) G_H_CH_OH_CH_I

(d) CH₄CH₄L C₄H₅OH

Hr S.B 9018.

46. The IUPAC name of ÇH ORLOH, îs-ĊH.

6 2-Cyclopropoxybutane

%/ 2-Proposybutane

(c) 2-Propozypropane

2-Methyl-2-propoxypropana

Mizoram S.B. 2018

47 Neutral ferme chiomde test can be used to distinguish between

for Alcohola and ethers (c) Autioes and aldebyde

(b) Aldebydes and ketones

(d) Phenois and alcohola

Mezorain S.B. 9018

48. On reaction with aqueous bromuse at room temperature phenol forms which of the following?

*ta i met*a-Beomingbena). fe. 2. 4. 6-Tribromophenol.

4. 2, 6-Dibromophenol

(d) 5 5 Dibromophenol

W B S.B. 2018.

art Answer Quasi

rarrying 2 or 3 marks



- Write the structural formulae of all the feomeric compounds that can be represented by the molecular formula $C_{\mu}H_{\mu\nu}$.) Write their R PAC names.
- How is amede prepared 7 How does it react with
 - o Br. or S.
 - 61 HNO, in the presence of H_sSO,
 - HI at 308-403 K?
- Explain the following
 - a) Phenyl methyl ether reacts with HI to give phenyl and methyl rodide and not rodobensene and mathyl airobol.
 - Dimethyl ether is completely soluble in water but diethyl ether is soluble in water to small extent.
 - C-O-C bond marke at ethernal rather than the H-O-H bond engle in water though oxygen is up? hybridized in both these cases. JPb.S.H. 90.1
- 4. How would you account for she following
 - (c) Phonol is more acadic than ethanol.

Ph. S.B 2016, Rr S B 2016

- (ii) The boiling points of ethers are much lower than those of the atcohols of comparable malar masses. D.S.B. 2007 Ph.S.B. 2017 Meghatoyo S.B. 2017.
- (42) Why do ethern possess dipole moment? (Pb. S.B. 2017)
- 5. Write the equations for the resistant of phenol with the following
 - .i) Br_q water
 - ii) CHCl_a + NaOH
 - (iii) Na,Cr,O, + Cone.H,SO, (Hr. S.B. 2018)
- 6. Explain the mechanism of the following reactions
 - (i) Acid catelysed dehydration of an alcohol forming an D.S.B. 2009. Mizorum S.B. 2017. 2018.

- Acid catalysed aydration of an elkene forming alcohol.
- Blustrate the following reactions giving a chemical equation. for each
 - () Kolbers reaction.

(D.S.B. 2070)

- of Williamson's synthesis.
- (D.S.B. 2010, Pb SB

- (OIT)
- (ii) Friedel Crafts alkylstion.

Pb. S B. 2017)

- How can you distinguish primary, secondary and tertiary alcohols by Lucas test ? (H.P.S.B. 2011 2017)
- (a) Convert phenol into sahovhe acid. CH P.S.B. 2018.
 - b' How can you distinguish primary, secondary and tertiary alcohols by Lucas test?

H.P.S.B. 3018, January S.B. 4018

- Explain Will amount synthesis. HP88 2018
- of Dimethyl ether has less boiling point than athyl cleaned Rombins H.P.S.B. 20181
- 10. How will you obtain
 - Prome and G. 4, 6-trusters phenometrom phenol.
 - 3 2-Methy) propens from 2-methyl propanol.

D.S.B. "011

(a) Complete the following reaction:

0H



b. Alcabela are comparatively more soluble in water than hydrocarbons of comparable molecular mass

H.P.S.B. 2012, 2016, Meghataya S.B. 2016.

- Name the reagents and give the equation for the 11 to preparation of 2-methyl-2-methoxypropane [CH, -C(OCH, (CH, CH, by Williamson's method
 - b) Explain why 4-nitrophenal is more acadic than 4-methogyphenol Meghalaya S.B 2023
- 13. Complete the following reactions:

OH

- 14. Give an example for each of the following
 - Kulbe reaction.
 - Reimer Tiemenn reaction. Abarkhand S.B. 2013)
- 15. How will you convert
 - Propene to propen-2-of
 - ii) Phenol to 2, 4, 6-transcophenol?

(D.S.B. 9018)

- 16. How will you convert the following
 - Propan-2-ol to propanone
 - Phenol to 2, 4. 6-tribromophenol. D.S.B. 2013)
- 17, .e) How will you distinguish between propen-1-ol and 2-methy-propan-2-ol "
 - Complete the following reactions

CH. C-ONe+C,H,Cl

CH.

OH



m) C_BH₅OCH₅ = 7 Meghaloye S.B. 201-D

- o) Write a chemical test to distinguish between phenoleand bearing and.
 - b. How will you convert phenol to benzoe and?
 - c How will you convert sodium phenoside to salaylic and? Ph S.B 1011
- Give a method of preparation of 3° alcohol
 - ... State the mechanism of the reaction

$$\mathrm{CH_2CH}{=}\mathrm{CH_2}+\mathrm{H_2C} \stackrel{\mathrm{H}^*}{=\!=\!=\!=} \mathrm{CH_3}^* \cdot \mathrm{CH} \cdot \mathrm{A^*H_3}$$

ιН

راتين Complete the following reaction.

- 40 Explain why sikony group (-OR is ortho, paradirecting and activates the aromatic ring towards electrophilic substitution. Assem S.B. 2018
- 20. •a Arrange the following compounds in increasing order of scidity H_aO, C_aH_aOH and phenoi
 - 46 How can the following pair be chemically distinguished? Phenol and ethyl alcohol

Or

- Write the structural formulae of all the possible ediers having the aniecular formula C₃H₁₆O and give their RFAC names.
- 4b Why are boiling points of others lower than those of alcohols? Maghalaya S.B ~6.5
- 21. What are primary, secondary and tertiary alcohols happens when primary, secondary and tertiary alcohols are oxidized using acidified KMnO₂?

Witarakhand S.H. 2015

- 22. fo Why are phenols acidic in nature?
 - (b) Explain the mechanism of the following reaction:

$$C_nH_0OH = \xrightarrow{Oose} \frac{S_16O_0}{440K} \rightarrow H_0 = PH_0 + F_0C$$

Ph S B 2018.

(c. Predict the products in the following reaction.

QF0.S.B.9018)

- 23. 'c How will you prepare phenoi from chlorobeazene ? Write equation
 - Expanse why the holing points of others are much lower than those of excobols of comparable molecular masses
 - How as pictric scall prepared? (H.P.S.B. 2015)
- 24 'a Why are phenois more acidic than alcohols? What happens when phenoi a treated with excess of squenus bromme solution? (Nagatard S.B. 2018)
 - Write the mechanism of send oatslyzed dehydration of ethanol to ethane
 - 4c Between phenol and alcohol which is more scale? Why? Karnataka S.B. 2018.

- (a) Discuss dehydrogenation of primary and secondary survival.
 - (b) What happens when vapours of primary, secondary and tertiary alcohols are passed over heated copper at 573 K. 7 (Hr S R. 2046)
- 26. Explain the following behaviours
 - (i) Alcohola are more soluble in water than the hydrocarbons of comparable molecular masses.
 - (a) Ortho-nitrophenol is more scidic than orthomethoxyphenol
 - (iii.) Cumene is a better starting materia, for the preparatum of phenot (CBSE Sample Paper 2017 18)
- 27 How do you convert the following
 - Phenol to anserte
 - b Propan-2-or to i-methyl, copan-2-or
 - (iii) Amline to phenol

Or

- Write the mechanism of the following reaction 2 CH₂CH₂OH ¹⁷ , CH₂CH₂O—CH₂CH₃CH₄
- b Write the equation involved in the acetylation of rubcybe acid. (D.S.B. 2015)
- (a Give a simple chemical test to distinguish between primary, secondary and tertiary alcohols

HPSB. 30 81

b CH_OC,H, + HI execute + A + B

Give structures of A and B products. (Hr.S.B. 2016)

- Compare the acidic strength of primary, secondary and terms electrons. Nagurand S.B. 2015
- 29. a How would you convert the following
 - (f) Phenol to benzene
 - (ii) Phenol to benzoquinone
 - (a) Propens to propan 2-ol
 - 76 How will you distinguish between benzyl alcohol and phenol?
 - a Complete the following reaction:

- (b) How do you rewant the unscibility of sthosyethnue or were?
- Among HI and HBr which to a better reagent for cleavage of ether? (Hr S B. 2016)
- Give the chemical equation for the reaction of ethanol with cone, H_aSO_a at 440 K.
 - Convert phenol to salicylic and (2-hydroxybensore noid).
- Meghainya S.B. 2016)

 81. © Why have ethera low coding points than someric alcohols?
 - (ii) Give the position momer of CH₃CH₂CH₂CH₂CH₂OH Puten I or Ph S.B 2016)
- 32. (a) Differentiate between primary secondary and tertiary alreholo by chemical test. Ph.S.B. B016
 - b Why are primary alcohols more acidic than secondary escohols?
 - Discuss the debydrogenation of primary, secondary and tectory acobols. (Pb.S.B. 2016)
- Ethere possess a dipole moment even if the alkyl radicals in the molecule are identical. Explain.
 - 'm Give the position isomer of CH₃CH₂CH.OH Propan-1-of Pb S B. 2016

ALCOHOLS, PHENOLS AND ETHERS



84. to: Write the IUPAC names of the following compounds:

 (i) CH_e · CH · C — CH_e

- 6. Starting from phenoi how phenolphthalem is obtained? J.K. S.B. 9016.
- 83. (a) Give one example of each of the following reactions (i) Reimer Tiemann reaction
 - a Williemsome symbesis

b) Convert. Propanone to 2-methylpropanol

Tripura S.B 2016,

- 36. An organic compound A(C₂H₆O) reacts with sodium to form compound B and hydrogen gas. When heated with conc H₂SO₄ at 415K, A produces C(C₄H₁₀O). C on treatment with conc HI at 373K forms D C is also obtained when B is heated with D. Identify A,B,C and D and write chemical equations for the formation of B from A and formation of C from B and D.
- 87 'a, Explain why alcohola are more soluble in water compared to shber?
 - b What happens when phenol is heated with Zn dust? Give equation.
 - c Name the following reaction:

38. Complete the following reactions.

39. (a., Complete the following resolima

- b Explain Williamson synthesis. (Kerola S.B 2016)
- 40 /c. Write the mechanism of the following reaction:

 Write the mean products) in each of the following reactions.

(ii)
$$CH_0 - CH = CH_0 \xrightarrow{C_1 B_0 H_1} CH_0 CH_0$$

(iii)
$$C_aH_a$$
—OH $\xrightarrow{\beta \in O(0_a, H^a)}$ D.S.B. **676*

- 41 . Phenol has higher boiling point than coluene. Why?
 - Why are alcohols energy probabased but phenols are not protonated? Ph S.B 2017.
- 42. a Discuss the acidic nature of phenols (Hr S.B. 2017)
 - b) Name any two tests to distinguish alcohol from phenol
 - p-Nstrophenol is more and/or than phenol. Explain why? Hr S B. 2017:
- How do primary, secondary and certary alcohols differ towards exidetion reaction? (Nagoland S B. 2017)
- 44. a Give reason why phenols are audic in nature
 - 6 Gave one general method of preparation of 8° alcohol Gave equation.
 - c Complete the following reaction and name the product CH_{*}—CH_{*}=CH_{*}+H_{*}O ^{B*}→ (Assam S.B. 2017)
- 40. a Complete the following reactions

(b) The following us not an appropriate reaction for the preparation of tert-butyl ethyl ether

$$\begin{array}{ccc} CH_3 & CH_4 \\ \downarrow H_5 & N_0 + N_1 & \downarrow & -\infty & \rightarrow CH_5 & \downarrow & -\infty \\ CH_4 & CH_4 & CH_5 \end{array}$$

- 46. (a) Arrange the following compounds in the order of marranging boiling points
 - Ethenoi Fropen 1-01 Butan-1-01 Butan-2-01

 In the lab. students were asked to carry out the reaction between phenol and conc.HNO₂ But one student, A' carried out the reaction between phenol and dil.HNO₂

 Do you think that the student A got the same result as others. Substantive with soutable explanations.

 [Also write the chemical equations wherever necessary.]
- 47 Lucas test is used to identify primary secondary and technical alcohols
 - Explain the process.
 - b) Name the rangents used in the test.

Keroja S.B. 2018)

CBSE QUESTIONS

- 48. Explain
 - f) Ortho naraphenol is more acide than orthomethoxyphenol
 - OH group attached to the carbon of benzene ring activates it sowards electrophilic substitution.

A.I.S.B 2005

- 49. How would you convert the following
 - () Phenol to benzogninone
 - is Propanous to 8-methy) propan-2-al
 - (rii) Propens to propan-2-al

AISB. 2010

80. How would you obtain the following

(i) Benzoquimona from pheno)

(ii 2-Methylpropan-2-of from methyl magnesium brounds (iii Propan-2-ol from propens. A.I.S B 2011

57. Explain the mechanism of acid catalysed hydration of an alkens to form corresponding alcohol, (A.I.S.H. 2019)

52. Explain the following

Alcohola are more ablable in water than hydrocarbona об сотрагавие толеоціал тазлев.

(ii Ortho mitrophenol in more acidic than ortho A.18 B 2012 methographecal

50. Explain the mechanism of the following reaction.

$$CH_3CH_3OH \xrightarrow{H^2} CH_3 = CH_3 + H_3O$$
 $(A.I.S.B. 20)3$

54. Write the mechanism of the following reaction.

65. Give reasons for the following

is a controphenol is more ended than a methogyphenol.

is. Butan-1-of has a higher boiling point than diethyl

fir CHa C O CH, on reaction with HI gives CH_{sts}C—I and CH_s. OH as the more products and not (CH_,,C-OH and CH_-I (A.I.S.B. 2015.

50. Write the chamical equations involved in the following meactabilia

Kulbe's reaction.

(it) Friedel Crafts nestylation of anisole

How do you convert

Phenol to toluene

(i) Formaldehyde to ethanol (ALSB 2016.

37 Gave reasons for the following

(c) Protonation of phenois is difficult whereas ethanol easily andergoes protonation

Boiling point of ethronol is higher than that of dimethyl.

4c. Anisole on reaction with HI gives phenol and CH₂ I sa mata products and not odubeness and PH₂OH.

A 8.8 2016

58. to Arrange the following amouston in the increasing order of their and alrenged р-степок р-насторійська, рівнаві

45 Write he mechanism using curved arrow notation of the following reaction:

$$^{\circ}H_{1} = H_{1} \xrightarrow{\alpha_{1}} H_{2} \xrightarrow{\beta_{1}} H_{2} + H_{2}$$
 Or

Write the structures of the products when Butan-2-of reacts with the following

for CrO. ta, 5001,

A.L.S.B 2017

Long Rossor Questions carrying 5 marks

- (a) Discuss the acids: dehydration of primary alcohols at 448 K
 - .b) Write Kolbe reaction of phenol
 - c) Write two case of methanol

z Discuss the dehydrogenetion of primary alcohols

b) Write the following reactions

(f) Diethyl ether with HI

ii) Phenol with benzene diazonium chloride

in. Alcohol with SOCL, (Pb. S.B. 2012)

2. (a) Discuss the sendic dehydration of primary alcohols at 443 K.

Write Remer-Tiemann reaction. ь

c) Write two uses of ethanol

a Why are ethers relatively mert compounds?

6 Write the following reactions:

Daethyl ether with Cl_a

(ii) Pheno) with zone dust

(2) Alcohol with PCl. Ph. S.H "012

5. Account for the following

i) Out of phenol and senzene which is more easily natrated and why?

(ii) Haw will you convert senzene diszonium chioride to phenol "

Friedel Crafts alkylation reaction.

Complete the following reaction:

$$CH_{0}CH_{0}OH + \{O\} \quad \frac{R_{2}G_{2}O_{2}}{H_{2}SO_{4}} \rightarrow \ 7 \ + \ 7$$

HP S.B. 2012

a. Write short notes on

ts Wurtz reaction

a Finkelstein reaction

air) Saytzeff's rule

6) Complete the following reactions

$$CH_{\chi} = CH_{\chi} + O_{\xi} + \gamma \xrightarrow{H_{\chi}O,Z_{\Omega}} \gamma$$

HP SB 2023

 a) Write IUPAC names of all the possible isomers with the molecular formula C.H.O.

b) Phenol is usually manufactured from cumens. Write the abmirture of rumene

e) Primary, secondary and tertiary alcohols can be distanguished by Lucas test What is Luces reagent?

ii) Write the observation for primary secondary and tertarry acobols in Lucas test. Kernin S.B. 2013).

What hoppens when phenol is wested with

CO. as a 7 atm pressure

6 Br./CS.

an CHCL, NaOH at 840 K.

Give reactions elso.

 b) How will you distinguish between isopropyl alcohol (Hr S.B. 2013) and ethyl alcohol.

7. a) Explain the mechanism of dehydration of alcohols to give alkenas.

 What happens when phenol is treated with (i) dil.HNO, (a) Cone HNO,

(c) How will you prepare phenol from

(tf) Diszonium salus (f) Haloarenas

ut) Cumene Hr S B. 2019.

8. (a) How will you prepare the following compounds deing Griguard reagent

Primary airchol

³ Secondary nicohol ³

b How will you distinguish primary and secondary atcohols. oaung Locas test ?

A. COHOLS, PHENDLS AND ETHERS

.c) Write the correct pair of reactants for the preparation of t-butyl ethyl ether by Williamson synthesis.

Kerola S B 2014

- Cove chemical reactions witen is reacted with
- (r) Zn

- (ii) Cone HNO,
- in Bromine weter
- (at) CHCl_a + eq. NaOH
- a) Chargue and

Explain with examples the preparation of alcohols by using hydroboration oxidation of aldehydes and ketones Also give chemical reactions involved. Hr S.B. 2015.

10, (g) Write the product(g) in the following reactions: OH

- re CH_a -CH—CH—CH_a -OH ^{PCC} →?
- (b) Give simple chemical tests to distinguish between the following pours of compounds
 - c) Ethenol and Phenol
 - Proposal and 2-methylpropan-2-al
- a. Write the formula of reagents used in the following
 - Browniation of phanol to 2,4,6-tribromorphenal
 - it: Hydroboration of propens and then oxidation to
- (b) Arrange the following compound groups in the increasing order of their property indicated
 - p-nitrophenol, ethanol, phenol (acidio character).
 - ii) Propanol, Propane. Propanal flodling ponce
- (c) Write the mechanism (using curved arrow outstion of the following reaction.

$$CH_3$$
: CH_4 : OH_5 : CH_5 : CH_5 : OH_5

Hints & Answers

tor **Revision Exercises**

Very Short Answer Questions

- But-2-ene, OH, CH = CHCH,
- 2-Methylpropene
- 4. Salieylaidehyde Reimer-Tiemann reaction

7. QH_—QH—QH_

Salinytic need)

- OH OH OH
- Phenn and recomethere.
- The old samples of ethers may contain some periodes because of their modation in the presence of aght. The permades of ethers may decompose violently on beating resulung serious accidents.
- e-nitroamente (minor), p-nitroamente (major;

- n- Веориалиліцаю (Mimor)
- p-Bromoeniente (Note No.
- Id. 2-Branio-3-methylbut-3-en-, oil

- $CH_1 = CH = CH_2 CH_3 CH_3 CH_4$
- 5 Bromocyclobexagol
- p-Nitminhenal
- 2 (~Pinutraphean)
- + 2C,H,I+H,O $C_H_CC_H_+ + \Omega HI$
- 2. Ethoxypentane
- 1, 1-Demethoxyethene
- 21 C.H.CH. -CH--CH.

- 29. (±1-Butan-2-o, represents recently morture of (++bucan-2-of and) +butan-2-o, which rotaces the plane polarised light in different directions but to equal extent Therefore, (± -butan-2-ol is optically meetave
- 24. 2 Methyl-propan-1,3-thol
- 2. Bramo-8-methylbut-2-en-1-al.
- 2-Mothony 2-methylpropone
- 27, 8-Phenylprop-2-en 1-ol
- 5, 3-Dimethylpentan-2-ol
- 99. (c) 30. (6) 81. (a)32. 5 35.
- 35. (b) 86. (a) 37. (b) 38. m
- 42 , 0 29. (d) 40. (b) 41. (c, 48. -G1 44. 45. 4Q. g. 47. d 48.

Additional Jeeful Information and Objective Questions

ADDITIONAL USEFUL INFORMATION

SOME MORE NAME REACTIONS

Allyl phenyl ether

Claisen rearrangement. When ally phonyl ethers are beated to 578 K, they undergo in ramolection rearrangment to which the allyl group imprates from the phenoic oxygen arous to ortho position of the beatene ring terming e-tilly! phenoi. This reaction is called Claisen rearrangement.

In this reaction, the bond between C—3 of the ally! group and the arrive proxime of the benzene ring forms at the same time so that the carbon—exygen bond of the ally! phenyl other breaks.

s-Allylphenol

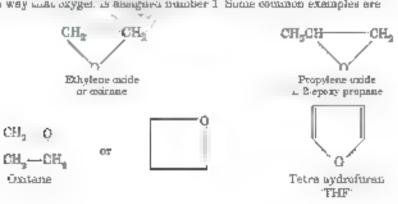
If both the orthe positions are compred, then the slipt group augmates to the pure position.

$$\begin{array}{c} \text{OCH}_2^-\text{ CH} = \text{CH}_2 \\ \text{CH}_3 \\ \text{F73 } \text{W} \end{array} \qquad \begin{array}{c} \text{CH}_3 \\ \text{CH}_4 \\ \text{CH}_5 \end{array} \qquad \begin{array}{c} \text{CH}_5 \\ \text{CH}_5 \\ \text{CH}_6 \end{array}$$

KIbs persulphate oxidation. Monthlydro phenois on code and with alkame putseanun persulphate give dihydric phenois

CYCLIC ETHERS

In addition to normal eithers, some evelor others are also important. Cyclic eithers are named as exides or epoxy compounds. The three and four membered evelor athers are named as extranes and exitanes respectively. In cyclic eithers, numbering is done in such a way that exygen, is assigned number 1. Some common examples are



2 2 Dimethy) onirane



1 4 Dioxane Diethytenedioxide

Epoxides are prepared by heating ethylene glycol at 500°C

CH_OH CH_

It is manufactured by beating ethylene and oxygen under pressure in the presence of silver catalyst at 200–400°C

$$\mathrm{CH}_{\eta} = \mathrm{CH}_{g} \to \frac{1}{2} \ \mathrm{O}_{g} \qquad \xrightarrow{\mathrm{Kill}_{g} \otimes \mathrm{CC}} \qquad \xrightarrow{\mathrm{CH}_{g}} \qquad \xrightarrow{\mathrm{CH}_{g}}$$

It may also be prepared by distilling athylene chlorohydrin with concentrated aqueous solution of Na. 94

$$CH_2OH$$
 + NeOH + CH_2 O + NeCI + HCI

Ethylene onde undergoes molecular recorangement en benting in form acsialdehyd-



The substituted epoxides are reduced to sicobola with LaA.H.

Dioxane is manufactured by distalling ethylene glycol with firming H.SO.,

It is a very aseful solvent

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions M. C. Q.

A GOPIEW With only one correct answer

Alcohols

- Al When ketones are treated with Gragourd reagent followed by hydrolysis with dilute sold, the product is:
 - a) Permany alcohol
- (b) Secondary alcohol
- c Tertiary airchol
- of Alkone
- Ad. Propens on hydroboration exulation produces
 - o Propan-1-ol
- (b) Propan-2-ol
- c) Propone-1, 5-daol
- (d) Propage-1, 2-dual

- A8. The product of end-catalysed by dration of 2-pheny (propensions)
 - (a) 2-phanyipropan-2-ol (b) I-phenyipropan-2-ol
 - ic 2-phenylpropan col id 3-phenylpropan-los
- A4. Which one of the following compounds would not be easily unitised by K₀Cr₄O₂ and sulphinde acid?
 - (a) CH_aCH_aOH
- (b) CH_{3/2}CHOH
- (c) $(CH_{3/8}COH)$
- (d) CH₂CHO.
- AS. Which of the following alcohols is most reactive with HCI in the presence of ZnCl₁?

(a) CH₃—Ç—GH (b) ÖB₃—ÖH→ ∪H₂OL

CH. CH-OH

d) OH,OH

CH,

- Aft. Isogropyi almbol is oxidised with K_cCr_cO_c and H_cSO_c to RIVE
 - .a) CH,CHO
- (b) CH_COCH_
- (e) CH_CH_CH_COOH (d) CH_CH = OH_
- A7. An alcohol of molecular formula $C_xH_{x,t}OH$ on dehydration gives an alkene, which on exidation yields a mixture of ketone and an and The arcohol is
 - a) CH, CH, CH(OH) CH, CH,
 - ch, chch, ch, ch,

- el (CH, CHCHOH)CH,
- d) (OH, GOH, OH
- Ethanol on warning with cone, H,SO, at 4.3 K gives
 - a ethene
 - b) distbyl ether
 - r' dimethy, ether
 - d ethyl hydrogen sulphote
- All. Which one/ones of the following reactions will give propan-2-of ? Choose the right answer from .a., .b), .c., and d)
 - $TH_0 = CH_0 + H_0 + H_$
 - CH,CHO

 - 'H,=CH-CH.

Neutral KMnO₊

- g I and II
- (b) H and H.
- c III and I
- d) II and IV
- A10. How many optically active stereousomers are possible for butane-2, 3-diol?
 - a 1

(5) 3

c) B

- (d) 4
- A11. 1-propagol and 2-propagol can be best distinguished by
 - a) arelation with alkaline KMnO, followed by reaction was Fehling mintage
 - ozodetjop vo ib emskir dichromate followed by reachon. with Fehlung solution
 - condetion by agating with copper followed by reaction with Feblue solution
 - condition with conn. H.M.), followed by reaction with Feirmg solution

- A13. During dehydration of alcohols to atkenee by heating with cone H.SO, the mittel step is
 - id. formalum of an eater
 - (b) protoportum of nicehal molecule
 - (c) formation of earbocation
 - (d) elementson of water
- A13. Which of the following will not form a yellow precipitate on heating with an alkaline solution of rodine ?
 - ch, ch, ch (oh) ch, = (b) ch, oh
 - c) CH,CH,OH
- d) CH,CH/OHICH,
- A.4. Among the following compounds which can be dehydrated: very enaily in

OH, CH, COH, CH,

ен,ен,ен,енси,

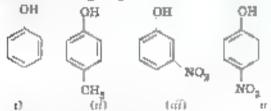
- HaCH, CH, CH, H
- сн,сн,сисн,си,он

A.f. The product P to the following reaction is

Phenois

- A16. Phenol is more acidic than ethyl alcohol because
 - (a) phenoxide you is more resonance stabilised than phenol
 - (b) there is more hydrogen bonding in phenol than ethyl-
 - (c) ethouse ion is iess reconance stabilised than ethyl
 - (d) phenol has higher boiling point than ethyl alcohol.
- A17 Reuner-Tiemann reaction is useful for the preparation of
 - aeuzoldetiyde
- ь saucytaidebyde
- ліпепа
- ų. ncetophenone
- A.8. Phenol on distribution with zinc dust gives
 - air debzebe
- bears)debyde
- *c benzoie seid
- .d benzoplieuone
- A.9. The end product in the following sequence is
 - D + ICH_ACO_MO
- A6. 0 A10. b A.1 c A32. b A13 6 A14 (0) A16. b A7 c A8. 6 AD. a A16.a A18. 01 A19. d

- Belanylar and
- Salicylaidebyde
- c) Phenyl scetate
- (d) Appendix
- A20. Which of the following reagent cannot be used to distinguis b between phenol and benzyl alcohol?
 - HDaN (D
- lo, NaHCO.
- (e) Br./CCI,
- (d) FeCl,
- A21 Phenol reacts with braining water of 'S. at low temperature to gave
 - a o-Bromophenol
- (b) o- and p-Bromophenol
- e) p. Bromopheoni
- d) 5,4, 6-Tribromophenol
- A22. In the following compounds



The order of acousty as

- 111. >
- (10) > (áp) 5-
- for 5
- 5 44
- 4 (iii. > 4
- A28. The order of reactivity of the following alcohols

[2 2

П

towards cope. HCL as

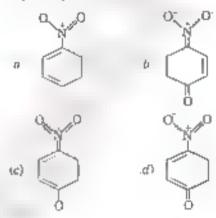
- a: I > II > III > IV
- (b) I > III > II > IV

IV

- c IV » III » II » I
- $\Pi \times I \times \Pi \times V$ (16)
- A24. The reaction of CH, CH OH with HBr gives

- CH₂CH₂CHB₇
- CH_CHB_CH_
- # CH_CH_CHBr

- A25. Which the following will give phenol with OnO and
 - (a., Seizeylie and
 - (b) Pierie need
 - (c) Benzor and
 - sel. Amino and
- A26. The most unakely representation of resonance structures of p-artrophenoxide con as



OH

- Anhydrom Cg. 16OH
 - to Call, Rall,
- the will, JO.H.
- (e) C_aH_aOC_aH_a
- d' O.H.I
- A28. When phenol is treated with CHCl, and NaOH, the product
 - (a Benealdehyde
- (b Salinylaldehyde
- (c) Sameylic ocid.
- ,of Benzone neld
- A29. When phenol is treated with sone.HNO, in the presence of error H₄SO_a, the product is
 - Pierrie aeidi
- (b p-nitrophenol
- a-mtrophenof
- a' m-catropheool
- A80. Which of the following is the atrongest and?
 - a-methoxyphenol
- b p-methoxyphenol
- at-methoxyphenial
- a' pheaol

Ethers

- AS1 Ethers are isometre with
 - (a) aldebydes
 - b vinyl alcohola
 - (c) alcohola
 - o" ketunes

A32. Diethyl ather on treatment with excess Cl., gives

- a perchiorodiethyl ether
- ethyl chloride
- e ethanoyl chiomde
- d) distinyl ether percents.

A35. Amenie reacts with HI at 878 K to give

- a [aHal + CHa +H
- b. CHT+C"H"OH
- e: C.H.CH.OH + CH.J
- a) CH_CH_I + O_H_OH

AS4. Ethers can be distinguished from alcohole by the following

- a reaching with No.
- b) reaction with PCI.
- reaction with 2, 4-directrophenyl hydrazine
- d') none of these.

A35. In the reaction

- E 48
- a Diethyl ether
- b _ Methoxypropage
- el Isopropyl alcohol (d) Propylene giyoul.

- A80. The compound which is not isomeric with diethyl ether is

 - (a) n-propyl methyl ether (b) 2-methyl propan-2-ol
 - (c) Butzmane
- (d) Butan-1-o)

A37 How many isomeric scyclic alcohols and ethers are possible 6m C,H,O 7

- (a) 5
- (6) 4
- 10) 6

(40) 7

A88. Disthyl ether on heating with cone. HI gives two moles of

- (a) ethanol
- (b) indoform
- (c) ethy) iodide
- (d) methyl jodate

A38. An either is more volatile than alrehol having the same molecular fluencia. This is due to

- (a) attermulecular hydrogen bonding to alcohola
- (b) dipolar character of ethers
- (c) alcohols having resonance struckures.
- (d) intermalecular hydrogen bonding in ethers

A40. The major argume product in the reaction

- (a) ICH, OCH) CHair.
- c CH, I + CH, s, CHOH
- (d' CH_OH + (CH_), CHI

A32.0 A30, a A40, c A33. 5 A84. a A85. 0 AUGH. & A37 d A88. -

MULTIPLE CHOICE QUESTIONS

from competitive examinations

AIPMT & Other State Boards' Medical Latrance

B1. Consider the following reaction.

Ethenol
$$\xrightarrow{\text{PSA}}$$
 X $\xrightarrow{\text{SLEWR}}$ Y $\xrightarrow{\text{SLEWR}}$ Z

The product Z is

id) CH₂CH₂OCH₂CH, b CH₃CH, \(\text{L}\) SU₃H

ic i H₃CH₄OH

if CH₄CH₅OH

if CH₅CH₆OH

Bg. Phenol
$$\xrightarrow{\text{Sin}, \leftarrow}$$
 $X \xrightarrow{\text{CEL}_1 \cap X} Y \xrightarrow{\text{Alkstone}} Z$

The product Z is

c) Benzene

- .c) Benzaldehyde
- Benzoir and
- d' Toluene
 - rC B.S.E PMT 2009)

BS. Which one of the following compounds ass the most acidic Domine ?

(C B.S E. P M T 2010)

- B4. Given are cyclohexanol (I), seetic send II), 2, 4, 6-transcruphenni (III) and phenni (IV). In these the order of decreasing scidic character will be
 - 60 H > ... > IV > I

6 III > IV > II > I

- (c) III > II > IV > I
- VI < I < II < III (b)

C B.S.E. P M.T 2010

Bit. In the following reactions.

(i) A HBt, dark C + D

b. observe of periodde [blayer product] [Major product]

the major products (A. and C) are respectively

- CH₁ CH₂ CH₂ CH₃ CH₃
- c CH₈—C—CH—CH₂ and CH₂—CH—CH₃
 Br
- CH₂ CH₃ CH₃

ALPMT SOL

B6. Which mie of the following is most reactive fowards electrophilic reagent?

B7 Among the following ethers, which one will produce methyl arcohol on areatment with hot concentrated HI ?

- b) CH_s -CH—CH_s—O—CH_s
 CH,
- e) CH_a -CH_a-OH_a-CH_a-O-CH_a
- or the the theory.

NEET YOU

- Ba. Among the following sets of reactants which one produces amode?
 - (a, CH,CHO RMgX
 - (b) CaHaOH NaOH CHal
 - t CaHtOH ocuma FeCL
 - of Salach, TH, TOT ACT (AIPMT 2014
- B9. Identify Z in the sequence of reactions.

CH_CH_CH_CH_CH_ HBLK_O Y QN,CM Z

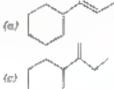
- (d) CHy-CH0/S O-CH6CH2
- (b) ,CH_{ab}CH=0=CH_oCH_o
- (c) "H., "H., O-CH,
- td CH₀CH₂ -CH(CH₃)-O-CH₂CH₃ (ALP M T 2014)
- BIQ. The reaction

e called

- (a) Etand reaction.
- b, Gettermann-Koch reaction
- (c) Williamson synthesis
- d. Williamson continuous etherification process

AIPMT 2010)

- B11 Resetton of phenor with charoform or one presence of drawe sodium bydroude finally introduces which one of the following functional group?
 - a CHCL
- A CHO
- a -CH Ö
- d COOH ALPMIT 1015
- B12. Which of the following is not the product of deby-instant of



- B18. Which of the following reagent would distinguish cis-cyclopents-1. 2-diol from trans-isomer?
 - a) MaO.
- (b) Аішпишкая ізоргоргизійе d) Ozona
- e' Acetone

INLET 2010)

B14. The reaction.

can be chassified as

- n debydration reaction
- Williamson alcohol synthesis reaction.
- Williamson ether synthesis reaction
- d) alrehel formation reaction

NEET 2016

B15. Which one is the most acidic compound? OH

(NEET 2017)

- B16. The beaung of phenyl methyl ether with Hi produces
 - o indobenzene
- (6 påena)
- c) benzene (d' ethyl chlorida

NEET 2017)

B17. In the reartion.

the electrophile involved is

- dicharomethy estion CHCla
- (b) formyl cation CHO)
- (c) dielileromethyl anion (CHCL.)
- (d) dichlimocrapane (rCCL)

CNEET S018

- B18. The compound A on treatment with Na gives B and with PCI, gives C. B and O react together to give diethyl ether. A, B and C are in the order
 - a C, F, OH, C, F, O, H, M
 - b) C.H.OH, C.H.Cl, C.H.ONo
 - (e) C₂H₅CI C₂H₈, C₂H₅OH
 - # J.H.OH. J.H. NA, J.H.O.

NEET 2018

B19. Identify the major products P Q and R in the following Becareoce of reactions

$$+ CH_{3}CH_{4}CH_{4}CH_{4}CI \xrightarrow{asthyd} AKCI_{4} \Rightarrow P \xrightarrow{b} {}^{b} {}^{c}_{4} \Rightarrow Q + R$$

CH.CHIODCH.

 $R = CH_0 + CO + CH_0$

NEET 2018)

- B20. The major product formed when 3,3-dimethylbutan-2-d is heated with concentrated surphuric acid is
 - (a) 1. 3- dimethyl-2-butene
 - 3,3-dimethyr 1-butene
 - S 3-dimethyt-1-butens
 - (d) cis and trans-isomers of 9,3-dimethyl-1-butene
 - (a) vis- and trans-isomers of 3.3-dimethyl-2-butene

Kerula P.M.T. (2007)

- B21. Which of the following alcohola gives the best yield of diality! ether on being heated with a trace of sulphuric acid?
 - (a) Pentan-2-al
- (b) Cyclopentanou
- (r) 2-Methyl hutrup-3-ol
- (d) Propan-2-ol
- (e) Pentag-1-ol
- (Kerwa P M T 2011
- B22. Which of the following will be most readily dehydrated un rendic conditions?

∧ (A, M L, Med, 20.3)

- **B29.** Which one of the following phenole has the highest pK_{\perp} value?
 - (a) a-Nitropheaol
- (b) Phenol
- (c) m-Manphenul
- od: Pierre audd
- to per-resol

Kerata PMT 2014

JEE (Main) & Other State Boards! Engineering Entrance

- B24 The major product obtained on interaction of phenol with NaOH and CO, 18
 - (a) Benzerr seid
- (b) Saheylaldehyde
- (c) Salteylie acid
- (d) Phthalic acid

41 EEE 2009

B25. The main product of the following reaction.

$$^{5}H^{5}\ \mathrm{H}^{2},\ \mathrm{He}\ \mathrm{H}\,\mathrm{0.Hb}\ \mathrm{J}H^{5}\mathrm{w}\qquad _{\mathrm{out}\ \mathrm{B}}\overline{\mathrm{sgc}^{4}}\rightarrow 1$$

(a
$$E = C \times H(CH_2)$$

A.I.E.E.E. 2010

- B26. The correct order of acidic strength of the following abauroquite
 - I Phecal
- II. p-Cresof / IV p-Nitropheno
- III. m. Narophenol

- 4a) IV > III > I > II
- H < I < II d.
- (c | > H > T > HI
- d' III > II > IV

4.1 E E.E 2011

- B27 Which of the following reagents may be used to distinguish between phenol and benzing sind?
 - Molacch rengent
- A No trei FeCt.
- Aqueoua NeOH
- (d. Tollen's reagent

ALKEE SOIT)

- B28. Ortho-nitrophenol is ess soluble is water than p-and m-mitrophenois because
 - to o-nitrophenol shows intromolecular H-bonding
 - (b) o-nitrophenol shows intermolecular H-bonding
 - (c) melting point of o-natrophenol is lower than those of or end pharmagers
 - d) o-nitrophenol is more volatile an eteam than those of ra- and p-ranniers (ALEEE 2019)
- B29. Arrange the following compounds in order of decreasing audity

- OH OH OHOCH, NO. ĊH., (I) (II)(III)(IV)
- n IV > III > I > II
- b □ > IV > I > III
- I > D > III > IV
- I II > I > A > IV

JEE Main Phil

B80. The most suitable respent for the conversion of

- (a, PCC (Pyrolineum chlorochromats)
- b BMn .
- KE KITO.
- d CrO. /

(JEE Main 2014)

B31. Bodium phenouse when heated with CO, under pressure at 425°C yields a product which on acetyletion produces C

The major product C would be

B92. The product of the reaction given below a

1. NESTAN

2 - 10/8 (205



JEE-Moin 2016"

aEE Main 2014

B33. Phenol on treatment with CO_b in the presence of NaOH foreward by archifecture produces compound Nas the major product. X on treatment with CH₃CO₁₃O in the presence of catalytic amount of H₂SO₂ produces.

"EE Main 2018

B34. Phenol reacts with methyl chioruformats in the presence of NaOH to form product A. A reacts with Br₂ to form product B A and B are respectively

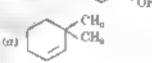
JEE Main 2018

B35. The major product farmed in the following reaction is:

(JEE Main 2018

B86. Identify the product/s in the following reaction

- BOLKS, HIS BOLD
- to CHICHOHOH,
- (e) CH_CH_CHO
- d) CH3CH2OH + CH3OH
- (v) CH_CHO + CH_OH
- Kerato C E.T 2007)
- B87 The hydracyl compound that gives a prempitate numediately when tracked with concentrated hydrochloric acid and anhydrous zinc chloride is
 - .c) 3-methyl-2-butenel
- (b) 3-methyl-I-batanol
- e 1-butenol
- (d' 2-methyl-2-batanol
- e 2, 3-dimethyl-1-butanol
- (Rerula P.E.T. 2011
- BSS. Find the product of the given reaction



«Onsso J E E 2011

- B82. An exygen containing organic compound was found to contain 52% carbon and 18% of hydrogen. Its vapour density is 23. The compound ceasts with sodium metal to liberate hydrogen. A functional isomer of this compound is
 - .es) Ethanol
- (b) Ethenei
- .c' Methoxy methons
- .d) Methoxy ethans
- Kernataka (E T 2012
- B40. Identify 'C' in the following

- (g) Water
- (b) Elbanol
- .е) Ргоранова
- to a management
- ,d) Cumens hydroperoxide Karnetaka C.B T 2012, 2018
- B41. Salicylaldebyde can be prepared from phenol by
 - a Echotten-Beumann reaction
 - b Anibe a regulario
 - Reimer-Tiemann reaction
 - d) Perkin reaction
 - e) Cannizzaro reaction

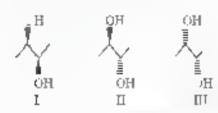
Kerata PET 2013

- B42. The total number of reyclic structural isomers possible for compound with molecular formula C₄H₁₀O is
 - a) B

(b) 7

6 (م. 8 (م.

- (d) 6 Kerda P E T 2013, 2010
- B48. Compound A of molecular formula C₄H₁₆O on treatment with Lucas reagent at room temperature gives compound B' When compound B' is heated with micoholic KOH, it gives isobutens. Compound A' and B' are respectively.
 - (a) 2-methyl-2-propanol and 2-methyl-2-chloropropane
 - .b) 2-methyl-1-propagol and 1-chloro-2-methylpropage
 - (c) 2-methyl-1 propanol and 2-methyl-9-chinropropana
 - (d) butan-2-ol and 2-chiorobutane
 - e) butan-1-ol and 1-chlorobutans (Kerala P E T 2013)
- B44. The correct statement regarding the following compounds



- a) all Aces compounds are chiral
- b' only a and H are chira.
- c) I and III are dester-coners
- d) only I and III are chiral.
- WB JEE 2014)
- B-45. Wilhamson's synthesis of preparing dimethyl other is a/ac.
 - .c) electrophilic substitution
 - b) Sul reaction
 - e) electrophilic addition
 - d) Sail ceaction
 - e free redical substitution

Revola PMT 2014

Karnataka CET POIS

B47 0 44 g of a monohydric alcoho, when added to methylmagnesium iodide in other liberates at S.T.P., 112 cm⁵ of methyne. Wist PCC the same alcohol forms a carbonyl compound that answers aliver mirror test. The amountydric alcohol is

OH

6 (CH ,C) 40

H

d) (GH_{afa} CH CH_aOH

(Karnataka CET 2014)

848. Arrange the following compounds in the increasing order of their ocklir strength

- m Natrophenoi

mailresoi

(in Phenol

(iv) m-Chiocophenol

'a) संदर्भ के संस्

the a city cresso

fer top e proces to

'd it < ii < iv < t Aarnotaka CET *0.6

B49. Which of the following compound would not react with Lucia reagent at room temperature?

/c, H_oC=OHCH_oOH

(b) C,H,CH,OH

fer CH_CH_CH_OH

(d) (CH_,,COH

/W B JEE 2010)

B50. Which of the following will be dehydrated most readily in alkaline medium?



/W B JEE 2010)

- B51. Isopropyl methyl ether when treated with cold hydrogen iodide gives
 - 'm/ Isopropyl indide and methyl iodide
 - (b) Isopropyl alcohol and methyl rodide
 - (c) reopropyl alcohol and methyl arcohol
 - (a' mopropy) todide and methyl alcohol

MH CET 20/0)

B52. In the reaction.

Ethanal Polate at KOH

 $\xrightarrow{H_g \exists O_k \text{ Noom range}} \mathbb{Z}$ the product \mathbb{Z} is

TO Call

4. CH, CH, JCH, CH,

(c) CH,CH,OSO,H

(g) OH

Kamatako CET 2016.

B53. The reaction which involves dichiorocarbene as an electrophile is

(u) Reimer-Tiemann reaction (b) Kolbe's reaction

(c) Friedel-Crafts acyletion (d) Fitting's reaction

Kornataka CET 2016.

B54. Ethanni is converted into athroxyethane

(a) by benting excess of ethanol with cone. H_3SO_4 at 140°C

6) by heating ethanol with excess of conc. H280, at 448 K.

(c) by treating with conc. H.SO, at most temperature

ed, by breating with cone. H.SO, at 273 K.

Karnatoka CET 2016.

B55. The structure of the product P of the following reaction is OH

OMe W B JEE 2017

B56. The products formed during the following reaction are

OMe

CH₃ CH₃

B57 Which of the following cannot be used to oxidise primary alcohols to aldebydes?

(a, CrO_s in anhydrous medium

(b) Pyrahaiam chlorochramate

(c) KMnO_s an acadia medanm.

(d) Heating to presence of Cu at 573 K.

Kornatoka CET 2017)

B58. Which of the following orders is true regarding the acidic nature of obenote?

(a) Phonol > o-cresol > o-nitrophenol

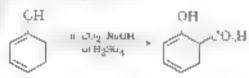
ψ ormesol (pieco, < φ-tutroptieno)

te Phenol co-cresol > o-nitrophenol

rd) Phenal < a-creed < a-cutrophenor

Karnatoka CET 2017:

B39. Name of the following reaction is



(a. Reimer-Tiemann

(b) Kolbe-Schmitt.

ic, Cannizzaro

e. Gattermann-Korb.

fd Gettermann (Kerwa PET *017)

B60. What product is formed when phenol is treated with CHCl₃ and NeOH?

3-Hydroxybenzaldebyde.

(b, 2-Hydroxybenzoid acid

tes 3-Hydroxybenzoic acid

2-Hydroxybenzaidehyde

IJ K CET "6.8)

B61. Methoxybenzene on treatment with HI produces

(a, indobenzene and mathanoi

(b) phenal and methyl rodide

rodobeazene and methyl rodide

(d) phenol and methanol

WB JEE "6.8)

B62. The intramolecular hydrogen bond is present in

(a) bpenaj

(h o-ustrophenoi (d p-creso)

(c. p-astrophenol

Kamatoka CET 2018

B63. Phenol can be distinguished from ethenol by the reagent

(o. bromine petpe

by sodium motel

(r) iron metri.

(d) chlorine water

Aarnotaka CET 20.48)

B\$2 d' B\$3 c B\$4, a B\$5, c B\$6, a B\$7, c B\$8, b B\$9, b B\$0, a B\$1 b B\$2,(b) B\$9, a'

- B64. When the vapours of tertury butyl alcohol are passed through heated copper at 673 K, the product formed is
 - o/ but-2-eas
- 767 boxan-2-one
- (c) 2-methylpropens
- (d) butanal

Karnutaka CET 2018,

- B65. What is the increasing order of andic strength among the following?
 - the primethoxy phanol. (a) primethyl phanol, (a), principle only
 - 2 4 1 4
- b 41. 5 x
- Per i < ii < iii
- (d) 1 < 14 < 4

Karnataka CET 2018

- **B66.** Oxidation of "alcohole to aldehydee is very successful for one airchole like
 - (a) pent-2-yn-1-ol
- 6/ because 1-of
- ic to-neopylaleshol
- of peoten-vol
- e octamica-or

Kerara PET 3018,

- B47. The balogen compound which will not react with phenol to give others is
 - ia ethyl chlonde
- To methyl citionde
- ic benzył chłonide
- (d) vinyl chluride
- (e) allyl chloride

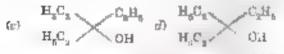
Keralo PET 2018,

JEE (Advance) for HT Entrance

B68. Ethyl ester

**Haftight ** P The product P is





LIT 2003

B80. $H_{0} \stackrel{H^{+}}{\longrightarrow} [F] \stackrel{B_{T_{2}} \cap CCT_{4}}{\longrightarrow} \\ C_{4}H_{8}Br_{6} \\ = \text{such products} \\ \text{are possible}$

How many structures of F are possible?

- d = A
- b 5
- 6 8

- at s
- FIFT TOOR

B70. Arrange the following compounds according to decreasing boding points

ОН ОН ОН ОН ОН

- (a) ((V)> (II)>(II)> J) 'b: III>((V)> II)> ()
- (c) (I)>,II(> III)> IV) (d) (III)>(II,>(I)>(IV) (I I T 2006)

B71 Identify the major products (P' and Q) in the following reaction.

and CH₂COCH₂

and CH₂COCH₂

and CH₃COCH₂

and CH₃CH₂CHO

B72. In the reaction

OCH, He of the products are

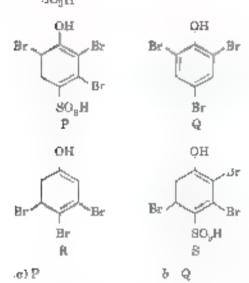
a Br OFH, and H,

- (b) Br and CH,Br
- (e) Br and CH_aOH
 - OH and Made

1 T 2010

B73. The major production of the following reaction as are:
OH

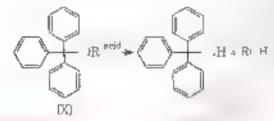




B74. The acidic hydrolysis of either (X shown below is factost when

GZ: DQ

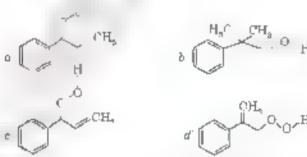
wiEE Advance 2015



- a one phenyl group is replaced by a methyl group
- b' one phenyl group is replaced by a para-methoxyphenyl group
- e) two phenyl groups are replaced by two paramethoxypheny) group
- d) no structural change is made to X

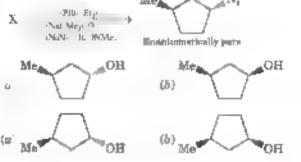
WEE Advance 2014)

B75. The major product U in the following reaction is



WEE Advance 2015

B75. In the following reaction sequence the correct structure(s) of X is are



JEE Advance 2018)

B78. (b) B74. (c) B75. (b) B76. (b)

C

o. R

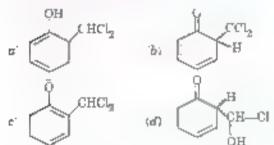
MULTIPLE CHOICE QUESTIONS

with more than one correct answer

- C1. Which of the following alcohole on debydration with case: H₀SO₂ give but-2-coc?
 - a R-Methyl propan-2-ol
 - 61 Butan 1-ol
 - c 2 Methyl propan-1-ol
 - nD Butan-2-w

- C4. Which of the following alcohous give redeform test?
 - (a, Butan-1-al
- b) Propan-1-ol
- (c) Propag-2-ol
- of Ethenol
- C8. Which of the following are weaker acids than phenol?
 - (a) 4-Methoxy phenol
- %: 3,5-dmitrophenol
- (c) 4-Methyl phenol
- (d) 4-Nitro phenol

C4. When phenol is treated with CHCl₃ and NaOH followed by scadification, schoylaldehyde is formed. Which of the following species are involved in the above mentioned reaction as intermediate?



C5. Which of the following are less acidio than CaHaOH ?

Cf. The other _________________________ when transert with HI produces

(Kerola PMT 2014

C7 In the reaction

LIT 2010)

- C8. Correct statements in cases of a-butanol and t-butanol at lare
 - (a) both are having equal solubility in water

Br

- b) . butanol is more soluble in water than a-butanol
- (e) boiling point of t-butanol is lower than n-butanol
- (d) brilling point of n-bottonol in lower thrin t-bulanol WB JEE Engg 9013
- C6. In the following reaction, the products(s) formed is (are)

- to P major)
- (b) Q (mmor-
- (c) Reminor
- (d) B major

JEE Advance 2013

- C10. The correct combination of names for some m similar with molecular formula $C_aH_{an}O$ is/are
 - a tert-butanol and 2-methylpropan-2-ul-
 - b feet butanol and 4, 1 dimethylathan 1 of
 - c in-butanol and bucan-I-ol
 - d) .so-butyl alcohol and 2-methylpropan-1-ol

UEE Advance 9014

C11. The resolavity of compound Z with different belogens order appropriate conditions is given below



The observed pottern of electrophilic substitution can be expressed by

- o) the steric effect of the halogen.
- b the stame effect of the fort-buty) group
- (c the electronic effect of the phenoise group
- .d') the electronic effect of the fart butyl group

JEE Advance 90.4

C12. The correct statement(a about the following renchina sequence in are

 $\operatorname{Currente} (\operatorname{C}_{g} H_{10}) \xrightarrow[(g) H_{2}O]{\operatorname{C}^{g}} P \xrightarrow{\operatorname{CH} \operatorname{Cl}_{g^{*}}} \overset{Q}{\operatorname{Na}_{g} \operatorname{OH}} + \overset{Q}{\operatorname{Minor}}$

$$Q \xrightarrow{N_0 \cap B} S$$

- p. R is steam volciale.
- Q gives dark violet colouration with 1 % aqueous FeCl, solution
- c S gives yellow precipitate with 9 4-dimitrophenylhydrasine
- d S gives dark violet colouration with 45 equeous FeCl₃ station.

(JEE Advance 2018)

C11. (a b. c) C12. (b. c)

MULTIPLE CHOICE QUESTIONS

based on the given passage/comprehension

Passage-I

Phenola react with chloreform in the presence of aqueous KOH at 540 K followed by hydrolysis of the resulting product give salicylesdebyde as



Answer the following questions

- III The above reaction is
 - a Remer-Tiemann reaction
 - Кибе в невоших
 - (c) Consuzzaro's reaction.
 - (d' Fries rearrangement.
- D2. The electropiule in this electrophiae substitution reaction.
 is
 - (a) ICCL,
- W TOOL
- (c) CHCl₂*
- (d) CF
- D3. When CCl₄ is used in place of CHCl₅ in the above reaction, the product formed is
 - (a) 2-Acetasybenzaic acid
 - (b) 2-Hydroxybenzoic acid
 - (c) 2-Carbasyphenol
 - td' none of these
- D4. When the product in D5 is heated with acetic anhydride and case, H_2SO_4 , the final product farmed is used as
 - (a) antiseptia
- b. tranquilizer
- (c) analgesis
- (of untiblotic
- DS. When product in DS is asseted with phenol, the new product formed in called
 - (a) oil of winter green
 - ,b: Balo.
 - cerbouc ecid.
- d espirion

Passage-II

Primary and secondary alcohols are debydrogenated by copper at 573 K to alikelydee and ketones respectively. In contrast tertiary sloohols are debydrated to alkenes by heating with copper at 573 K. Sumilarly primary alcohols are easily oxidised to form first an eldebyde and then a carboxylic axid while secondary alcohols are exidised to ketones which are further conduced to form a maxture of exide. Tertiary alcohols are exidised with difficulty and with strong condising agents in axidic medium. They form first ketones and then axide In the case of alcohols containing carbon-carbon double bond, some condising agents oxidise both double bond and -OH group while other reagents donot affect C—C bond.

Answer the following questions t

D6. In the reaction



D7 In the reaction

$$\stackrel{\text{H}}{\longrightarrow} \stackrel{\text{OH}}{\longrightarrow} F$$

The product Pis

D8. Butan-2-of on heating with Cu at 573 K given

(c) propagone (d) but-2-ene

D9. The reagent which exideses 1" alcohol to aldehyde without affecting C=C double bond is

(o) CrO_s in aqueous acetone solution

(b) aqueous K₂Cr₂O₂

(c) alkalma kMnO,

(d) gone of these

D10. The product of the reaction

so 2-M hylpropanic

2-Medigipropaggraph

(c) Butanous send

→ Butain-2-one

Развице-ПІ

themer Tiernam reaction introduces an aidehyde group on to be account a may if phonol, with: to the hydroxyl group. This reaction involves electrophilic eromatic substitution. This is a general method of the synthesis of substituted salicylaidehydes as depicted below.

Answer the following questions:

D13. Which one of the following reagents is used in the above reaction?

(a) ag NaOH + CH_eCl

(b) so NaOH + CH_2Cl_2

(c) on NaOH + CHOL,

td' og NnOH + CCl,

D12. The electrophile in this reaction is

9 THCI

5 THE

(c) CGL,

661 TOOL

 CH_{q}

D13. The attructure of the agreemed are 1 id.

Pressage-IV

A serbary alreadol H sport and casalysed delightration gives a product 1 - 'zonotysis of 1 lends to compounds J and K. Compounted apon reaching with KCH gives benzyl airchoi and a compound L, whereas K on reaction with КОН дамев этау М

$$M = P_b$$

Answer the following questions

D14. Compound H is formed by the reaction of

D15. The a meetr as of compound I is

D16. The structures of compounds J. K and L respectively are

- (a) PhOOCH, PhOH, COCH, and PhOH, COO'K*
- (b) PhCHO PhCH₀CHO and PhCOO·K*
- (e) PhCOCH_a, PhOH_aCHO and CH_aCOO^aK^a
- d PhCHO PhCOCH, and PhCOC K*

Passage III. D16. 5 D14. 0 D15. 3 Dic. d Passage IV

Assertion Reason Type Questions

The question given below consist of an Ascertion and the so the following key to choose the appropriate answer

- If both assertion and reason are CCRRECT and reasons a the CORRECT captement on of the assertion.
- If ooth assertion and reason are "ORRECT" but reason a NOT THE CORRECT explanation of the sasertion.
- If assertion is CORRECT but reason is INCORRECT 107
- Hassertion is INCORRECT but reason is CORRECT
- If both assertion and reason are INCORRECT

- Assertion: The boiling points of alcohole are higher than those of Lydrocarbons of routparable concoular
 - A conola show intramolecular hydrogen
- Reason
- Assertion: Phenoi andergoes kolbe a reaction but ethanol does ant
- Pheno: s more acidic than ethanol Reason

mass.

- The C-C-C bond angle at others is higher 3. Assertion: than H-O-H bond angle in we er
- Oxygen in both ethers and water in ap³ Reason hybrodized.
- Assertion: The houling point of distbyl ether is much less than that of ethanol.
 - Reason In ethanol, the molecules are associated by the formation of intermolecular hydrogen bouding wherens to diethyl ether it is not possible.

5. Assertion Airohole have higher boiling pointe then ethers

of comparable molecular masses

Renson Alcohole and ethers are isomeric compounds

6. Assertion: p and p-nitrophenolecan be separated by storm

distribution

Reason

o momenta stand valuable due to chelation
while personer is not steam voletile due to
association of molecules by intermolecular

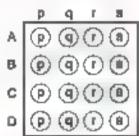
H-bouldang

5. (b) 6. .c.

Matrix Match Type Questions

Each question contains statements given in two columns, which have to be matched. Statements in Column I are labelled as A. B. C and D whereas statements in Column II are labelled

as p. q. r and s. Match the entries of Column I with appropriate entries of A Column II. Each entry in Column I may have one in more than one correct. B option from Column II. The enswers to these questions have to be appropriately bubbled as illustrated. D in the following example.



If the currect marches are A-q. A-r. B-p, B-s, C-r, C-s and D-q. then the currectly bubbled matrix will took like the following:

 Match the compounds in Column I with the properties in Column II

Column I	Column 11
A buttan 2-00	p cree andir than phonoi
B. Smithophenoi	σ governikens with 30 to 573 K
C) p-cresol	(r) more acidic than ethanol
D) 2-methylpropro-2-ol	s' gives taluezas au reduction
b	with zone dust

в Ар В г Срз др

Matching List Type Questions

1 Match the chemical conversions in Liet with the appropriate reagents in List II and select the correct answer using the code given below the lists.

List I	List II
$\begin{array}{c} P. \nearrow CI \longrightarrow \nearrow \\ Q. \nearrow ONa \longrightarrow \nearrow OEt \end{array}$	1. (i) Hg:OAo) ₀ (ii) NeBH ₄ 2. NeOEt
R OH	a. Ethr
b OH	4 BH ₂ (a) H ₂ O ₂ /NaOH

	P	Ď	R	S
(0)	2	8	1	4
b'	급	2	1	4
.e)	2	3	4	1
ch.	2	2	4	3

2. Last-I contains reactions and Last-II contains inspir products

List 1	List II
P. >ONa + >Br	1 — он
Q. →OMe + HBr →	9 ≯dr
R. → Hr + NaOMe →	3 ≯oMe
9. Jone + MeBr >	4 1
	* 14 X

Match each reaction in Last-I with one or more products in Last-B and choose the currect option. The currect option is

- 14 P + 1 1 Q + R + 8 +4
- b P + + + Q + R + 4 S + 5
- r P + 1 4 Q + 2 R + 1 4 8 + 4
- d) P +4 1 Q +4 R +4 S +3.4

2. 6

JEE Advanced 1916

(1) (a

(B) (b)

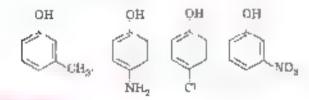
Integer Type or Numerical Value Type Questions

Integer Type. The enswer to each of the following question is a single-digit-integer ranging from 0 to 9.

 The number of alcohole giving redulium tent running the following is

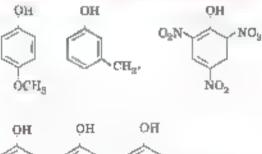
chichton chich chichtonich chichtonichtonichtenichtenichtenicht chichtonichtenitereniterentenich

How many of the following compounds have lower pK_a value than phenoi?



5. 1

4. 5.



- OH OH OH

 CH₃CH₂OH

 CH₃CH₂OH
- 3. How many of the structurally asomeric pentyl alcohols will give immediate turbidity in Lucus test?
- The total number of stemphonic removes having the updecoder formula \(\frac{1}{2}\text{H}_{14}\) and

- How mean of the following compounds give " account with tengmend reagons. HaMgRe as Acetaldehyde, Formaldehyde, Ethylethanoate, Acetone, Carross. Acetyl chaoride, Aretamide, Carbon dioxide
- Methyl methanoute 6. How many of the following of athers remnot be prepared by Williameon a synchesta

 $\mathrm{CH_5OC_2H_6}, \mathrm{C_6H_5}_{20}\mathrm{O}, \mathrm{C_6H_6}\mathrm{JOH_6}, \mathrm{C_6H_6}\mathrm{OC_5H_6},$ ch, coch, ch, ch, o c, k, ch, oc, h, ch, oc, h,

The author of resonance structures of N is.

· EE Advence 2015.

The number of hydroxyl groups an \(\gamma\) is

LIEE Advance 2015).

Numerical Value Type: Give the correct numerical value in decimal notation truncacetyrounded off to the second decimal place

9. For the given compound X, the total number of optically active stereotapmera ta

- This type of bond indicates that the configuration at the specific carbon and the geometry of the doubte aond is fixed.
- ANY This type of bond indicates that the configuration at the specific carbon and the geometry of the double aond is NOT fixed

(JEE Advance 2018)

5. 2

0. 2

7 9

B. 4

8, 7,00



NCERT

Exemplar Problems /



- Multiple Chaice Questions(Yups:l) 🎔

- Monochloman on of tomene to suning. Tollowed by bydrolysis with so NeOH yields
 - .c o-Cresol.
- (b, m-Crama)
- c 2 a Dibydroxytofuene
- d' Benzyl aircabol
- 2 How many alrohous with in secular formula C.H., C are chiral in nature?
 - a 1

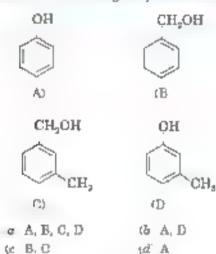
b: 2

- (d' 4
- What is the correct order of reactivity of alcohols in the following reaction?
 - R-OH + HCL
- → R-Cl + H₆D
- 0 1 >2 >3
- 0 1 48 23
- C 3" =)" > 1"
- d 3 > 1 > 2°

Objective Questions

- 4. CH, CH, OH can be converted non "H, "HO by
 - (a ostalytic hydrogenation
 - to treatment with LAH,
 - (c) trenkment with pyridinium chlorochromote
 - (d) treatment with KMnO.
- 5. The process of converting alkyl helides into alcohols TAMBLE
 - (a addition reaction
 - audoes accidentalistics of
 - c sebyárobalogensous reaction
 - d' rearrangement reaction

6. Which of the following compounds is aromatic alcohol?

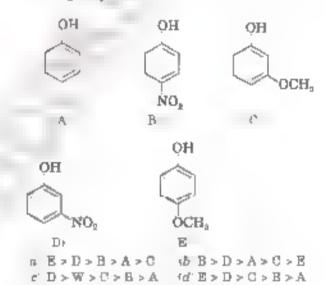


7. Give IUPAC name of the compound given below

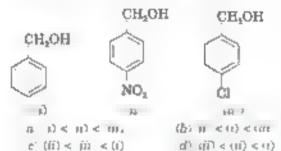


- .a 2-Chioro-6-nydroxybenane
- 9- Hydroxy-5-diagrobexage
- c 5-Chioreheam-2-sl
- # 2- Thiorofexan-5-of
- 8. IUFAC name of m-cresol is
 - a 3-methylpheonI
- & 3-chiorophena)
- (c 8-methoxyphenn)
- (d) senzene-1,3-diol
- A. TUPAC name of the compound OH₁ CH OCH₃ IF CH₄
 - .a 1-methoxy-1-methylethane
 - 6 2-methory-2-methylethane
 - (c. 2-methoxypropage
 - (d) isopropylmethyl sther
- 10. Which of the following species can act as the strongest base?
 - g eoH
- V. BUE
- e ≅OC,H,
- (d) %)—(N)
- 12. Which of the following compounds will react with sodium hydroxide solution in water?

- to CaHaOH
- (b) C,H,CH,OH
- (e) (CH_{a/a}COH
- d) U_nH₁OH
- 12. Phenol is less scidic than
 - to ethanal
- (b) n-natrophenol
- .c) o-methylphenul
- (d) a-methoryphenol
- 15. Which of the following is most acidic?
 - o Benzyl alcohol.
- (b. Oyclohexanol
- c) Phenol /
- (d) m-Chlmophenol
- Mark the correct order of decreasing said strength of the following computeds.



 Mark the correct increasing order of reactivity of the following compounds with HBWHC!



 Arrange the following compounds in increasing order of boiling point.

Propen a or buten and buten-2-of penum find

- a Prepair I of busin-2-or butan I-of pentan I-of
- 6: Propan-1-ol, butan-1-ol butan-2-ol pentan-1-of
- Pentan-Los bucan-2-o) butan --o) propen --o)
- of Pentag-1-of august and busen-2-of propers 1-as
- d (c) 7. (c) 8. (a 8. (c) 10. (b) 11. (a 19. (b) 18. (d) 14. (b) 16. (c) 16. (a

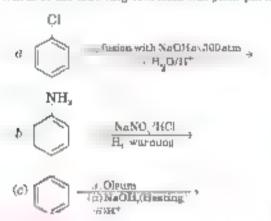
- Multiple Chaire Questions (Type-II) --

Note In the following questions two or more options may be correct.

- Which of the following are used to convert RCHO into RUH, pH ?
 - a) H_/Pd
 - b) LaAlH,
 - (c) NaBH,

17 a b r

- d' Reaction with RMgX followed by hydrolysis
- 18. Which of the following reactions will yield phenol?



- 19. Which of the following respents one be used to endise primary alcohole to aldehydes?
 - to CrOs in anhydrous medium.
 - hi KMnO_a in acidia medium
 - c' Pyrubaiam chlorochromata.
 - .d) Heat in the presence of Cu at 570K.
- Phenol can be distinguished from ethanol by the reactions with
 - a Br./witter
- b Va
- .c) Neutral FeCl.,
- of) All the above
- 21. Which of the following are benzylic alcohole?
 - a) C_sH_s -CH_s-CH_sOH
 - (b) C, H, -CH, OH
 - g) C₆H₅ -CH—OH

ĊH_a

" Calla CIL CIL OH

ĊH_a

10. a

20. a c

21 0 4

22 Motel the name of Column Land Johnson II in the following questions

Column 1	Column II
CH ₄	t2) Hydroquinoue
OF	,
b ОН	. Phenetale

22. Match the starting materials given in Column 1 with the products formed by shess (Column Π in the reaction anth HI

24. Metch the items of column I with items of column II.

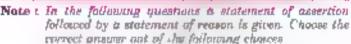
Column 1	Солина П
b Autdreeze used a car engue	Neutra ferme
	oblimade .
b Solvent used in perfumes.	(ii) Glycerol
c. Starting material for print and	/ Methanol
(d' Wood spirit /	(iv) Phenoi
r Rengent sed for deter on of phenobo group	Ethy-ene glycol
P By product of anap industry used in cosmetics	o Ethansi

26. Match the stead of column with items of column II.

Culuxen I	Column II
n Metaunol	Conversion of phenot to o-hydroxysalicyhe acid
h. K. Magis respektion	Ethyl nleohol
.c) Williamson's synthesis	(sji) Conversion of phenol to safetylaldehyde
a Pon eraso of 4º acrobol to ketone	a / Wood spirit
Remer Tiemano reaction	 Heated copper at 573K
Fermentalian	 Reaction of alkyl hands with audition allianide

29.torstol; b, of, c' at table 24. 'a) w, th (wit; te) tab; d diet; te) (e, thid) 28.au art b a ord in a milk

Resertion and Reseat/Tiple Quarties



- (a) Assertion and reason both are correct and reason is correct explanation of assertion
- (b) Assertion and reason both are wrong statements
- (c) Assertion is correct statement but reason is wrong eru, emetr
- d' Assertion is wrong statement out reason is correct
- (e) Both casertion and reason are correct statements but reason as not correct explanation of assertion
- 26. Assertion Addition reaction of water to but-I-ens in acidic medium yields butan-1-ol-

Renson: Addition of water in acidic medium proceeds through the formation of primary carbocation.

- 27. Assertion p-nitrophenol is more acidic than phenol. Reason / Nitro group being in the stabilisation of the phenoxide ion by dispersal of negative charge due to тевопапсе
- 28. Assertion: IUPAC name of the compound $CH_3 - CH - O - CH_3 - CH_3 - CH_4$

CH.

is Z-Ethoxy-2-methylethone

Reason in I I At nomencleture, ether is regarded as hyurocaruou pertvative in which a hydrogen alone is replaced by "OK or "OAr group where K = alkyl group

and Ar = ary group:

29. Assertion Bond angle in others is slightly less than the tetrahedral angle Renson There is a repulsion between the two bulky

R groups 80. Assertion Boiling points of airchole and others are high Reason They can form intermolectuar hydrogen-banding

26. .6 (2) 28, (d) 29. (d)

- 33. Assertion: Like invariant of benzene, brommetten of phenol is also carried out in the presence of Lewis and Henson: Lewis and polarises the bromme molecule
- 82. Assertion a o-Natrophenou is seas soluble in water than the mand p-isomore

Reason we and p-Narophenous exist as associated molecules

33. Assertion: Ethanol is a weaker acid than phenol Reason. Sodium ethoride may be prepared by the reaction of ethanol with aqueous NaOH.

84. Asserteon Phenol forms 2, 4, 5 tribromophenol on treatment with Br₋ in carbon disulphide at 275K. Reason Bromine polyriess in carbon disulphide

85. Assertion Phenologive p and p-astrophenologistical with cone. HNO and H,50, maxture.

Reason : OH group in phenal is p- p-directing.

31. d 32. e 33. e 34. b 35, (d)

Hints & Explanations for Difficult Objective Type Questions

A. may with only one correct answer

At
$$x \in \mathbb{R}$$
 $(\mathbb{R}^{n} + \mathbb{R}^{m}MgX) \rightarrow \mathbb{R}$ $(\mathbb{R}^{n} + \mathbb{R}^{n}) + \mathbb{R}^{n}$ $(\mathbb{R}^{n} + \mathbb{R}^{n}) + \mathbb{R}^{n}$ $(\mathbb{R}^{n} + \mathbb{R}^{n}) + \mathbb{R}^{n}$ $(\mathbb{R}^{n} + \mathbb{R}^{n}) + \mathbb{R}^{n}$

The reaction hydroboration oxidation involves aduction of water molecule in accordance with Markornikov a rule

- A4. .c. A tertiary alcohol is very difficult to be condised because it does not have hydrogen on the carbon bearing. OH group-
- A5. .a Tertiary alcohols have greater reactivity .5" > 2" > 1")

A0. a I CH₂=CH=CH₃
$$\xrightarrow{H_3^{\text{tot}}}$$
 CF₃ 4 F CF₃
OH
2 Proposed

- A.1 c I Propanol and 2-Propanol of the presence of copper (heat undergo dehydration to give CH₃CHO and CH₃COCH₃ respectively. These can be easily distinguished by Februar columns.
- A.1. 6 First step is protoustion of sloober R/*H_(*)H_1 + H* RCH_, *H_1

 Protounted sloobel
- A.3. b —The compound which does not contain cH_{a} —cH— group will not give indefend test

OH

A.4. a The compound $\operatorname{Ch}_0(\Pi_1\operatorname{CH}_0\operatorname{CH}_0)$ produces anot stable 3° carbonston and, therefore the compound will undergo dehydration most easily

Alface. The greater and a character of phenol is due to more renominar stability of phenometer on than phenol

- A22. d . Phenol is more acidic than cream but uses acidic than introphenol p-introphenol is more acidic than in-introphenol. Thus, the current order is p-astrophenol > m-introphenol > phenol > cresor.
- **A23.** r The order of reactivity depends upon the stability of raphorations formed. The relative stability of the carbocations follows the order

 $Ph^2H_a > CH_a \stackrel{\bullet}{\to} H = CH_a > PA^2H_a CH_a \stackrel{\bullet}{\to} H = CH_a = PA^2H_a = CH_a = C$

A24. b. The addition of a proton at β-carbon gives a carbonation II which is resonance etabilized accause of electron domining affect of -4.4h group. The addition of Br. ion to the carbonation gives the main product.

A26. c. Nitrogen cannot have 10 electrons, more than acters in its valence shall

A37: $\delta = C_2H_3O$ is better musteophtic ℓ attack C_2H_3I than C_3H_3O . In C_5H_3O the negative charge is delocateed over the benzene ring

A30. (c) At an -position. -Of H₂ group does not exert as +R effect Instead at exerts its. I effect and therefore are methoxyphenol is a strongest and among phenols, or, mo or p-methoxyphenol.

A81 c Ethers and accohols are functional isomers CH₂CH₂OH or CH₂OCH₂

ARE. (b). OCH₃ OH +
10
 10 10 10

A84. (c., Alcohols react with sedium while others donot react

ABS. (c),
$$C_3H_6OC_2H_6 + 2HI$$
 $\xrightarrow{\text{Heat}} \Rightarrow 2C_0H_2I + H_6O$
Ethyl include

A40. (c) $CH_1 = O - CH(CH_{\pi/g} + HI) \rightarrow CH_1I + CH_{\pi/g}CHOH$

B. mog from Competitive Examination

B1 c
$$CH_1CH_1OH$$
 $PBr_{3.}$ > CH_3CH_2Er $Aic.KOH$ $CH_3 = CH_2$ H_3SO_4 H_3CO CH_4CH_2OF H_3CO H

- B3. d' Phenol is the most acidic among these.
- **B4.** (c). Phenois and carboxylic acids are more acidic than abplicate alcohols, therefore, cyclohexano. It is least acidic to the first phenois. If it is more under than IV because of the presence of these electrics withdrawing. Not, groups on the beasene ring which make. If bond as highly polarized. Acetic and if it is more neither than phenois and cyclohexanol but less scalic than transcriptional.

Beuzote and

Therefore, correct under is

B5. b CH.CH. CH. CH.
$$\xrightarrow{H^{-1}}$$
 CH.C. CH. $\xrightarrow{H^{-1}}$ CH.C. CH.C. $\xrightarrow{H^{-1}}$ CH.C. CH. $\xrightarrow{H^{-1}}$ CH.C. CH.C. CH. $\xrightarrow{H^{-1}}$ CH.C. CH.C. CH. $\xrightarrow{H^{-1}}$ CH.C. CH.C. CH.C. CH. $\xrightarrow{H^{-1}}$ CH.C.

B6. b Electron described decreases in the order - 1 H 2 CH $_{3}$ 2 NHCCH $_{3}$ 2 CH $_{4}$ 2 CH $_{4}$ H. Therefore, CH group is most choosingly electron denoting group and hence $\phi - \phi$ orders is most reactive towards electrophilic reagent.

B7
$$\sigma$$
 CH₅—C \cdot OCH₃ + HI \rightarrow CH OH + CH₃ \cdot CH₄ CH₄ \cdot CH₄ \cdot CH₄

- Ba. b. $C_aH_aOH \xrightarrow{BaOH} * C_aH_aONa \xrightarrow{BH_aJ} C_aH_aOCH_a$
- **B9.** σ CH₅ 'H₂ 'H=CH $\xrightarrow{\text{differ BigOp}}$ CH₃CH₂CH₂CH₂CH₂Br $\xrightarrow{\text{Callight QNa}}$ 'H₃6 'H₃6 -C---C-H₅ Z
- B11 452. The reaction of phenon with chloroform in the presence of dif. NeOH is called Riemer Trement reaction.

B18. (c) Accione can be used to distinguish between cis and trans- diots. Cis cyclopenta. ∠ i distinguish forms cyclic ketal with accione, whereas truns-isomer cannot form cyclic ketal.

Cis-cyclopenta 1 2-dio)

Cyche ketal

B15. ϵ Electron withdrawing group $|N_{ij}|$ increases the aridity of phenot

B18.05 Phenol Phenol

B17. d). It is a Reimer Tiemann reaction and the electrophile is dichlorocarbene $-\mathrm{OCl}_2$

Big. 9 CH_3CH_2OH $N_8 \rightarrow CH_5CH_2ON_0$ (B)

 $\begin{array}{ccc} \operatorname{CH_2CH_2OH} & \xrightarrow{\operatorname{PCl_p}} \operatorname{CH_2CH_2CH} \\ & & & & & & \end{array}$

CH₂CH₂ONa + CICH₂CH₃
(C)

→ GH₆CH₉OGH₂CH₃
Disturbation

- B21 r Property alcohol pentanos of readily forms ethers when needed with cond. H,50, and gives best yield.
- B23. .e. CH_n—OH p-reeso contains electron donating group. CH_n, which decreases actually. Hence, pK_n value is highest for p-cresol.

B25.
$$c = C_0 H_0 C H_2 - C_1 H_0 C H_2 - C_2 H_0 C H_2 - C_3 H_0 C H$$

$$C_{g}H_{g}$$
 CH_{g} CH_{g}

NOTE

Dehydration occurs in such a way that the double bond comes in conjugation with the $C_{\mathfrak{g}}H_{\mathfrak{g}}$ group.

B26. $(a_i, p$ -nitrophenol > m-nitrophenol > phenol > cress)

B27 & Phenon gives violet colour with neutral FeC q and bearing and gives oulf coloured ppt

B29. d' Correct order of ecucle strength is
$$OH OH OH OH OH$$
 $OH_3 OCH_3$

III) / (II) III) (IV)

B30. n., PCC is highly effective for maintaing 1" alcohols to aldehydes.

NBS asta sa allylic bromineting agent

$$\textbf{B36.} \ \ \textit{a} \quad \text{3CH}_{3}\text{CH} + \text{CH}_{4} \quad \overset{\text{BH}}{\longrightarrow} \quad \text{CH}_{3}\text{CH}_{4}\text{CH}_{5,3} \ \text{B} \qquad \overset{\text{H}_{2}\text{O}_{2}}{\longrightarrow} \quad \text{OH}_{4}\text{BO}_{3} + \text{3CH}_{5}\text{CH}_{4}\text{CH}_{5}\text{OH}_{5}$$

ÇH₃ **B37.** (al). Tertracy alcohol CH₁—CH₂—CH₃

OH

2-Methyl-2-butanci

$$\mathbf{B38} \quad d' \quad \bigcirc \overset{\mathrm{CH}_{3}}{\longleftarrow} \overset{\mathrm{CH}_{3}}{\longleftarrow} \overset{\mathrm{H}_{3}}{\longleftarrow} \overset{\mathrm{CH}_{3}}{\longleftarrow} \overset{\mathrm{H}_{3}}{\longleftarrow} \overset{\mathrm{CH}_{3}}{\longleftarrow} \overset{\mathrm{CH}_{3}}{\longrightarrow$$

B30. .c). Molecular formula can be calculated as.

Element	Percentege	Atomic mass	Moles of atoms	Mole ratio	
Ø	52	/ 12	52 = 4.33 12	$\frac{439}{219} = 2$	
н	18	/ 1/	13 - 10 1	$\frac{10}{2\cdot 19} = \delta$	
O	06	18	$\frac{35}{10} = 2.19$	$\frac{2.19}{2.19} = 1$	

Empirical formula = $C_1H_{a^2}$. Molecular mass = $2 \times 30 = 46$

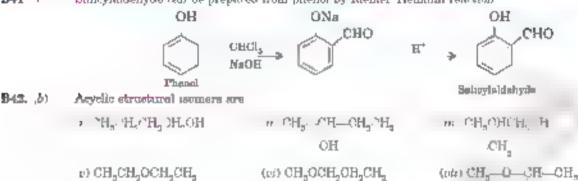
Empirical formula mass = $2 \times 12 + 6 \times 1 + 1 \times 16 = 40$

$$7 = \frac{46}{16} = 3$$

Maleemar formula - CpH_aO

Since thaberedes agree agree by reacting with sodium, we as simbolice. CH₂CH₂OH. Its functional isomer is CH₂OCH₃ are thosy methane.

B41 c Salicylaidehyde can be prepared from phenor by fixemer Tremann reaction



B48. 6)
$$CH_3$$
 CH_3 CH_3 CH_3 CH_3 CH_4 CH_5 CH_5

2-Methylproper (2-u)

2-Methyl-2-chlimpropone

B45. a Williamson's synthesis is a nucleophilic substitution rescion, and proceeds via S_n2 mechanism.

.19 cm³ of CH_s is obtained from alcohol = 0.44 g.

22.400 cm³ of CH₄ wall be obtained from alcohol. =
$$\frac{0.44 \times 22400}{1.12}$$
 = 88 g

Already must be a primary already because it rearts with PU' to give carbonyl compound which answers after nurror test. Therefore, (b) or d is correct But b is correct because it has molec mass 88 g.

B49. The order of reactively of abrohous towards Lucas reagent is 3° ×2° ×1° Therefore. L'ancohous fonot react with Lucas reagent at room mongero are. The benzyl and anyl anohous react as repully as 3° acrohous with Lucas reagent because their corbocations are reactive and are stabilised and are stable. Thus CH_CH_CH_CH_OH_L' alcohous seast reactive.

OII' in not a good featuring group but the expulsion becomes easy due to conjugated structure

B52. of
$$CH_3CH_3OH \xrightarrow{PCl_3} CH_3CH_2C$$
 of $ROH \to {}^{4}H \xrightarrow{P} CH_2 \xrightarrow{H_2BL_3 \text{ From Salley}} C_2H_3 \xrightarrow{H}$

B54. **
$$2CH_3CH_4CH$$
 $\xrightarrow{Conc. (90)_4}$ $\xrightarrow{T_4CH_5}$ $\xrightarrow{T_4CH_5}$

- B57 x^* Annihiled KMn x_0 candides already to carboay for arridadirectly. Aqueous a realization KMn x_0 rate be used to existing already to added yields
- B58. b Electron releasing group -CH₃ decreases acidity of phenol and electron withdrawing group -NO₂ increases acidity of phenol Thus, o-cresol < phenol < o-mitraphenol

B63. (co. Phone) gives whose precipitate with somes of transme water due to the formation of 2, 4, 6-trabromophenol.

Aucohol does not react with promine water

B65. r Electron withdrawing group increases and/o strength while electron doubting group decreases the audio strength of phenol

- BG6. .e). Long chain alcohols are successfully oxidized to aldehydee.
- **B67.** (cf), $CH_0 = CH = CH_0 = CH = CH_0$ Since C.-Cl acoud acquired partial double bond character -c will not undergo substitution.
- B68. a Exters add two moles of Gragnard reagent to form 3° autohole. Since the Gragnard reagent is CH₃MgBr, the product must contain at least two methyl groups. Therefore, the only choice deveny two CFs, group is in

B70. a Increase of number of hydraxial groups increases the bound points. Among isomeric dehydroxy benzenes as the distance between the -t H group increases, the repulsion between their decreases and hence bound point increases. Thenol = 151, 771 - 11 catechol = 24, 571, 411 resortinol = 28, 74 and IV quinol = 285°C.

B71
$$c$$
 CH_3 CH_3 CH_3 OE
 CH_3 CH_3 OE
 CH_3 CH_4 OE
 CH_5 CH_5 OE
 CH_5
 CH_5

B74. .c Rate of B_oI reaction is proportional to the stability of carbocation. When two phenyl groups are replaced by awa MeO. — groups, the carbocation formed will be more stable. Therefore, the reaction is the fastest

C mcq with more than one correct unswer

.6:
$$\mathrm{CH_3\,CH_2\,CHCH_3}$$
 H of $\mathrm{CH_3\,CH}$ CH, $\mathrm{CH_3\,CH}$ CH, $\mathrm{CH_3\,CH}$ CH, $\mathrm{CH_3\,CH}$ But 2-ene

C2. c.e. Alcohols containing CH, CHOH group, e. "H₃CH₃"F CH₂CHCH₃ give adolorm test Butant-I of OH

"H₃CH₄CH₄CH₂CH and propant1 of CH₅CH₅CH₅CH donot give his cest

C3. (a.c. 3.5-dumor) and 4-mitro phenois are stronger unde than phenoi because mitro group acroases the multy of phenois.

C4. (b,c). The reaction inschanging is

C5. $b_i c_i = {}^{\circ}_{ii} H_{ij}$ H and obvessol are less andic than phonol whereas astrophonole are more andic

C7 .c,c Pheno' being aridic reacts with Nat H to form phenoxide on Since Offigroup is on p-directing therefore. Breaters at o and p-positions.

CB. b. . Boiling point decreases as branching increases. Solubility increases with branching

(40. $\sigma \in d \in C_1H_{10}$) is a monohydror accoholic $\in C_2H_0 \cap H$. Its isometric alcoholic acco

x is and z are suitable positions for a tack as per electronic effect of $-\infty H$ group. Due to sterm effect of test-butyl group, the bulky electrophiles are sees. Lety x as ack at non-times x and z. Hence, position x is suitable for x_2 , positions x and z are suitable for Bx_1 . But CL being smaller and stank an the three positions x is y and z.

 ψ forms intramolecular hydrogen bonding and R forms intermolecular hydrogen bonding. Therefore ψ has low bonding point and is steam volume while R has logh outday point and is not steam volume.

w gives dark molet colouration with 1% aqueous FeCl₅ solution because it has phenolic. OH group, S gives vellow ppt with 3.4-directionly hydrazine because it has carbonyl. CHO group but does not give viniet colouration with 1% aqueous FeCl₅ because it does not have. OH group.

D. mcg based an comprehension

Di. a., The reaction is Reimer Tiemenn reaction.

D2. (b). *ICl, contains sextet of electrops and bence is a strong electrophile

D15. (a).
$$P_h = C \cdot CH_g P_h$$
 $\xrightarrow{H' \to H_{gl} O} P_h \cdot C = C \cdot P_h$ CH_g

Die,
$$d$$
) Ph. $\hat{\zeta}=\zeta$ [Diph. Respectively Ph. $\zeta=0$. CH. $\zeta=0$

$$J = PhCHO$$
. $K = PhCOCH_p$

HELP

With PCC, modatam can be stopped to aldebyde stage

Matching Type Questions

Integer Type and Numerical Value Type Questions

- 8. . Only territory alcohol gave t orbidity in Lucas test in CH₃ C+CH₂CH₉ All others will be 1 or 2'

- 5, 2 Formeidehyde and ourane give primary alcohola
- 6. 2 Williamson's synthesis requires that the aikyl balide should be primary and advande may be primary secondary or techniz. Hence two ethers which cannot be prepared by Waarmson's synthesis are \(\frac{1}{2} \text{H}_{\frac{1}{2}} \text{H}_{\frac{

The resonating structures of N are.

There are four hydroxyl groups in (Q)

9 7 00 These are eight asomers and one of those a... first 1 as optically mactive Therefore, the number of optically active asomers as 7

(optically inactive meso)

NCERT Exemplar Problems MCQs Type-I

Q. (a) CH₂CH₂CH₂CH₂OH, CH₂· CH—CH₂OH.

- .c The reagent pyridmium chlorochromate controls the oxideuou to endebyde stage
- (b) Weakest and has strongest anyugate base Since ROH
 is the weakest arid, therefore, RO is the strongest
 hase
- a) Phenol is more acadic than alcohols, therefore, it dissolves in NaOH
- 12. (b) Phenol is less acidic than c-astrophenol because electron withdrawing group .—NO₂) increases the acidir strength.
- 14. (b) Decreasing acidic strength

.5. (c) All the three beneyl sicobols react with HBr/HC1 through the formation of intermediate carbocation. More stable the carbocation, more reactive is the sicobol. The electron releasing groups i.e. NO_n, CI decrease the stability of the carbocation. Suits NO_n group is stronger electron withdrawing then. CI group, therefore, stability of carbocation increases in the order.

$$NO_{i}$$
 $CH_{i}^{+} \in CH_{i}$ $CH_{i}^{-} \in CH_{i}$

Therefore, the reactivity of beazyl alcahols increases in the order H < HI < 1

.6. .a. Bosing point increases with increase in ninlecular mass of the alrohols. Among someric alrohols 1° alcohols have higher bosing points than 2° alcohols. Thus, correct order is:

propan-1-d < butan-2-d < butan-1-d < pentan-1-d

NCERT Exemplar Problems : MCQs Type-II

- 17 a), (b) (c) Except RMgX, all other reagents reduce RCH₂OH to RCHO
- (a), b., (c) Chlorobenzene does not undergo hydrofysis on treatment with NaOH n. 298 K. All other three options are correct



timi	e allowed 2 Hrs. M	laxımını Marks	85
1	Write chemical equation for the preparation of phenci from chlorobenzene.		1
2.	Predict the products of the reaction		
	CH_CH_CH_OCH_+ + HBz >		(1)
3	Why di test-butyl ether cannot be prepared by Williamson a synthesis" Explain.		1
4	Which of the two, phenol or o-introphenor are more andw and wily?		1
ō.	What is the order of reactivity of 1 - 2" and 3" alcohols with somiting that d?"		1
ø.	Write the reactions and conditions involved in the conversion of		
	(i) Propens to propan-1-ol (ii) Phenoi to sameyir and.		(2)
7_{τ}	Write the IUPAC names of the following		
	ÇH,		
	מייז מע מע מער מער מער מער מער מער מער מער מ		(2)
	(12) CH ₂ CH ₂ OCH(CH ₂)CH ₂ CH ₃		رخديا
	T OH		
úr	CH, Wete make a control day whenever of arbana' to once other a		4.
ρ.	Which of the two. C. H. A. H. and H. A. Branch and a shall		2
	Which of the two $C_gH_g \cup H$ or $_{g}H_g \cup H$ is more acidic and why? Cyclic $C_gH_g \cap H$ has H is assumed. Write their struct, we said names.		15
	Write the equations involved in the following reactions		. 4
	.7) Kolbe's reaction		
	(ii) Remer-Tiemann reaction		
	(ivi) Williamson ether synthesis		ε,
19.	Write chemical equations for the following reactions		10
	(i) Friedel Craft's acylation of anisoie		
	(H) Broaunation of pnenoi		
	(ii) Sulphonation of obenol /		(9)
TS.	Give chemical tests to distinguish between		
	(2) Methanol and ethanol		
	(b) 1-Propanol and 2-Propano		
	(c) n-Propyl chloride and iso-propyl chloride		(3)
14.	How will you convert the following		
	(i) Propene to propan-2-or		
	(ii) Phenol to benzoic acid		
	"ii) Propan-1-of to propan-2-of		(8)
ъ.	Explain		
	. Ethers possess dipole moment even if the alkyl redicals in the molecule are identical.		
	 But any points of others are lower than their corresponding acolaris. 		
	Cal. Ethers are relatively mert.	((8,
10.			
	* balatution *		
	(b) Discuss the oxidation of 1°, 2° and 3° alcohols.		
	(c) Explain hydroboration reaction with an example.	(2,9	2.13

► To check your performance see HINTS AND SOLUTIONS TO SOME QUESTIONS at the end of Part II of the book



ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

Building on		Assessing		Preparing for Competition	
 Inderstanding Test. 	1	· Quich Memory Test with		 Additionisis Jeeful Information 	13
• Conceptor: Questions 50	5, 00	Anstoers	117	◆ Toperwise MCQs	2
CHAPTER SUMMARY & QUICE		 HOT8 & Advanced Level 		 impetitive Bantonovias Qa 	
CHAPTER ROUND UP	92	Questions with Answer	[](]	- AJPMT & Other State Bonedo	
NCERT FILE		REVISION EXERCISES with Previous Years (BSh. Je.		Medical Entrance > JEE Man & Other State	14
 In-text ⊌e & Exermede with 		& Other State Pounds Qu	235	Boards Engineering Entrance	14
Solutions	97			# JEE (Advance for ITT Entrance	15
 Nº 'ER'' Exempler Problems with 		Exercises	1.90	♦ Nº ERT Exempler Problems	
Answers & Solucions Subjective	113	UNIT PRACTICE TEST		Objective Mirestors,	TÇ.
		UVILLET TOUR LEGI	187	a Winds E. Bambanatana for	



In the National plants and arima to carry group. They are widely spread in plants and arima to compounds also with functional groups containing carbon-oxygen double bond. These contain an important tunctional group >C=O known as carbonyl group. The majority of mobiler by important compounds come a carbonyl group. They are widely spread in plants and animal forgion and play an important role in many biochemical processes of life. They are used in many tood products, pharmaceutical agents and synthetic materials like performes, plastics, fabrics, paints, resins, adhesives, etc., needed in our everyday lives.

 Hinta & Explanations for Difficult Questions

	Name Gener	al structurki formela	Functional group
I	Afdehyden	k	C =
	(Ackanolii	H	Ú
2	Kelmpe	·* =:	1 2
	Alkanone	7	41
			1
]	Carbonylie acida Assuran muds	H C -01F	
-	4erd derivatives	0	
	/ Apyl tad ados	R -C X	
	. 1313.13013013	$A = P \cdot q_{\rm obs} \cdot q_{\rm obs}$	71
		C .	
	Acid hallydrides	8 € 4.∞ " 8	. "
		ſ	i
i	Rickern	H = 4 R	ıFt
		t.	_
	Appl namides	· ()	NH

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PART A

ALDEHYDES AND KETONES

Aldedydes and ketanes are compounds which contain a carbonyl group $\mathbb{R} \mathbb{C} = \mathbb{C}$ and therefore these compounds are conjectively raised earbonyl compounds. The electronic structure of carbonyl group is

There is a double bond between carbon and oxygen. Because of difference in electronogrativity between O, the $\mathcal{L}=0$ bond is polar. In a)dehydes, the carbonyl group is attached to wither two hydrogen stoms or one hydrogen, stom and one sikyl or arvl group, whereas in ketones, it is attached to both alkyl or aryl groups. Thus,

where R may be H, askyl or ary-R C=0 group Aldebydes П

Waere Rimay be = R' and alky or arvi-R C=O ETOL D

The functional group of aldehydes -c=0 is also called a deby $d\in \operatorname{group}$ while the functional group of ketones, Č≕O is called ketonie group.

If the two groups are the same in a kettone $R = R^{\gamma}$ the ketoro is called a simple ketone. On the other hand, if the two groups are different, the ketone is called a mixed ketone.

> $CH_* - C = O$ $C_0H_0-C=0$

NUMERO LATURE OF ALDEHYDES AND RETURES

on. Naming aldehydes. In the common system, aldo tydes are named according to the name of the corresponding curboxylic and which they form on oxidati in. The notifix tie acid of the name of the acid is replaced by aldehyde For example CH₂CHO derived from acetar and H₂COOH is usually as acetaidehyde

> Acetic acid-ic acid + aldebyde = Acetaldebyde CH_{λ} C=0CH,COOH Agettic a cad Acetaldehyde

Branching in the aldehyde chain if $m_{\rm F}$, is addicated by the Greek letters α , β , γ , δ , etc. The curbon attached to the -CHO group is or, and so on, as

-C--C--CHO

For example,

сн сно CH.

сызсы, снемо сыден сы

a-Methyl propionaldenyde

to Methyl butyraldehyde

B-Bromobutyreldehyde

In the IUPAC system the aidehydes are known as alkanais. The name of aidehyde is derived by replacing the terminal to of the name of corresponding alkane by all For example,

> HCHO Methanai

CH,CHO Ethana)

 C_nH_nCHO Propanai

A kane C + B= AJKGDB

The branched chain aldebydes are named by the following rules.

The longest chain containing the CHO group is considered as the parent chain and the name is derived by replacing the terminal -e of the name of the corresponding alkane by the suffix - nl.

- In case of substituted aldenydes, the parent chain is a subsered at such a way that the aldehyda group CHO gets lowest number s.e., 1.
- The positions of the other substituents are indicated by numbers.

(ii) When the aldebyde group is attached to a ring the suffix carbatchyde is added after the full name of the cycloalkane. The numbering of the ring carbon stoms starts from the carbon stom attached to the aldebyde group. For example,

Is may be noted that the carbon atom of "CHO group is always assigned as reun er 1. Therefore it is not necessary to indicate the position of the aldebyde group."

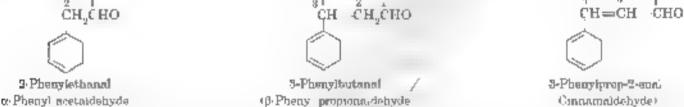
A net of rommon and IUPAC names of some important aidehydes are given below

Pormula	Common name	IUPAC nome
H⊾H⊾	Formaldehyde	Methanai
CH,CHO	Acetel/debyd+	Etheruú
CH CH CHO	Peoplonaldaliya	Penghastal
CH'CH'CH', HO	4. Butyruckaryda	Butanui
CH_CHCHO	Imbutyrotdahy.e	2-Methylpropenal
CH ₃		
CH, CHOOL H, CHO	a-file wasy propounddebyde	2-Methoxypropana.
сијсијен чено	coldectivi butyraldetivde	3-Martig/Hostensió
сн_енено сн _*		
ĊH,	β. Methyl butyrzidebyde	3-Methylbutann.
си сисисно	B-Chart-o methy butymids byte	8-Claurte 2-methylloceanal
Ć ĆH _a		
он, ен, онден, оно	n Volernidehyde	Pentanul
сн _е снен _е сно	/ Ensymbered dashyda	3- Methylbutena)
CH ₃ 9 ² 1 CHO	(-Methy) cyclobexane carbaldebyde	8-Methytcyclobexane carbaldebyde
сн_сн сно	Acroleso.	Prop-2 enni
СН _е СН—СН—СНс	Crotonaldebyde	But 2 erasi
C°H° CH≕CHCHO	Comamaidelivde	8-Phenylprop-2-enal

In aromatic aldehydes, "HO group is directly attached to the venzene ring. The name of the simplest aromatic aldehyde carrying aldehyde group on benzene is benzene carbaldehyde. However, the common name benzaldehyde is also accepted by fUPAC. The other aromatic aldehydes are therefore named as substituted benzaldehydes. In case of substituted aromatic aldehydes, the post-ions of the substitutents in benzene ring with respect to "CH" group are indicated either by sulfixes or ho, meta or para or by numbers 1, 2, 3 — etc. with the carbon bearing the "CHO group as number 1.

och,

 $CH_{a}CH_{c}C \cap CH_{c}CH_{a}$



(b) Naming of ketones. In the common system, ketones, "re-named by using the names of ally) groups present in the molecule. For example,

CH,COCH, Dimethyl ketone CH_COCH_CH_CH_

Methyl a-propylketone

CH_COCH_CH_ Ethyl methyl ketone THIC ICHICHAG

Diethyl ketone $C_aH_aCH_aCOCH_a$ Methyl iacpropyl ketona Benzyl methyl ketone

Some of the ketones are known by then or $1 \, \mathrm{pop}_{-1}$ at $1 \, \mathrm{omes}$ as well. For example, $0 \, \mathrm{dim}$ $0 \, \mathrm{sign}$ ketone, $0 \, \mathrm{CH}_{2} \, \mathrm{COCH}_{2}$ is still popularly known as acctone-

In the HPAC system, the ketones are known as alkanones. The individual members are named by following the general rules as

The longest chain carrying the carbonyl group is considered as the parent chain and the name is derived. by replacing the termina. < of the name of corresponding alkane by the suffix one.

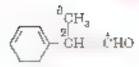
34 In case of substituted ketones, the parent chain is numbered in such a way that the keto group gets, he lowest number.

The position of the carbonyl group and the substituents is indicated by numbers. For example,

ch, co ch, ch, ch, CH, CH, CO CH, CH, CH,COCH, Propenone 2 4 Dimethylpen.com-3-one CH. 2, 5-Dimethylberka-9-me 4-Methylpent-3-en-2-one -Cyclottexylpropen-1-one 2-Methylcyclohexanone Common name Mesity) ands

8,7-Dimethylocta-2, 6-dienai

5-Ammo-4-nydroxyltexan-3-one



3. Phenylpropaual

In cyclic ketones, the carbonyl carbon is given the number 1

9. Methylcyclohesannere

3-Methylcy/Ippent-2-eq-1-me

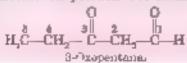
3. Methylryclobutacone

A jist of common names and IUPAC names of some important ketones are given below

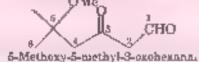
Formula	Common name	ПРАС name
CH, COCH,	Dimethyl ketone (or acetone)	Propensase
ен,сосн,сн,	Ethyl methyl fretons	Butamone
ĊĦ,ČOCĦ,CĦ,CĦ,	Methyl n-propyl katone	Pentan-2-one
сн,сн,со сн,сн,	Dietby ¹ ketous	Pentau-5-me
си _з сосн -си,	Methyl Japropy) ketere	9-Methylbulan-2-one
CH, CH,CHCOCHCH, CH, CH,	Гизоргоруі какове	2, 4-Dimethylpentan-3-one
thath, the	Acetyl scetone	Pentane-3.4-dione
сн, с с сн,	Bacetyl	Butane-2, 3-dione
CH C—CHCOCH	Mezityl oxide	4 Methylpent-9-en-2-one
CH ₃	(A Methyl cyclobeannone	2-Methylcyclohezanone
CII ²	β- Methyl eyeropentanone	9-Methylcyclopentanoue
С— сн ₂ сн ₂ сн,	Ethylphenyl ketone	r Phenylpropen-1-one
$\operatorname{CH}_{2} = \operatorname{CHCOC}_{10}$	Methyl vmyl ketone	But-3-ea-2-oae
CH CH=CHCOCH	Benzal acetone	4-Phenylbut-3-en-2-one

REMEMBER

If the compatible continue both much side and keteric grants, then aldehyde group as considered as principal functional group and ketome group is regarded as substituent. It is somed as prefix oxo-along with a mamber to indicate its position. For example,



СН,СН,ССН,СНСНО 3 Метру-4-имплектий



Furely aromatic or maked aliphatic aromatic ketones are asually known by their common names. For example,

Π PAC 1998 Recommendations of Aldehydes and Ketones

According to a est 1998 IUPAs' recommendations, if an approximated chain as the set of the core had two some for chonal groups, the organic comparation named as a convertise of parer to keep which does not not dethe carbon atoms of the Panetonia groups. These are mades by use of suffix tricarboxy he would for three. COV H. groups tricarbaldehyde for these CHO groups in tricarbonitarile for have. "Nymatic This, for an organic compound containing three -CHO groups.

Perpane I 2,3-transfluidehyde Not formerly 4-Porms 1 5-day

totage: 2 4-tmensbaldelivde Not formerly 3-Formythemans 1, 8-dual

If here groups are not carectly conded it the intronches region, than, the two also groups are considered in the parent chan, and are named by using the prefix done one the true of the functions, group. The third group forming the side chain is considered as a substituent group. For example

$$CH_{\underline{u}}CHO$$
 $CH_{\underline{u}}$ $CH_{\underline{u}}$

SOLVED EXAMPLES

■ Example 1....

Write the IUPAC names of the following compounds

$$\Phi = OCHCH_2CH_2CHO \qquad e = CH_3 \qquad C = CH = C = CH_3$$

$$CH_3$$

Uttorakhand S.B. 2014,

The (CH_o, CHCHO

(Nagarand S.B. 2018)

(Hr S.B. 2018, 2018

Mizoram S.B. 2013

(Assam 8 B. 2015

Solution of CH₂CH = CHCHO But-2-engi

c
$$CH_{\alpha}$$
 C $C = C$ CH 4 Methy pent-3-en 2-one CH_{α}

Cvdlohex-2-en-1-one

5 4 3 2 1 .b OCHCH,CH,CH,CHG Pentane 1 5-dia)

8,5 Drchwrobonzeneonrbaldehyde

Example 3 ...

- Write the structural formulae of all the earliesel a repounds with the momentur formula C_bH₁₀O and name them according to RPAC system.
- (b) Write the structural formula of the following
 - 3 Phenysprop-2-ena. a 4 Methytpen 3-cm-2-one
 (a) 3-Methylbutanal (a) 4-Chiorogenian 2-one

CBSE Sample Paper 2007 (A.I.S.B. 2011)

(c) Write the IUPAC names of the following compounds

.
$$CH_1$$
 CH CO CH CH_2 CH_3 CH_4 CH_5 $(D.S.B. 2007)$

CH_CCHCH_

O

A.I S.B. 2012/

S-Methylustan-2-ons

$$\sigma$$
 CH_{8} CH_{*} $CH = CH$ C H (A.L.S.B. 2012,

(Hr S.B 2018

Solution : of The possible structures and IUPAC names are

b
$$CH = CH - CHO = H_3C - C = C - CH_3 = CH_3 - CH - CH_2 - CHO$$
 $CH_3 + CH_3 - CH_3$

💰 🤌 2.4-Dimethylpentan-Stone 🗓 Peno2tenai a 3-Phenylprop-2tenai a 1-Phenylpropan-Lone

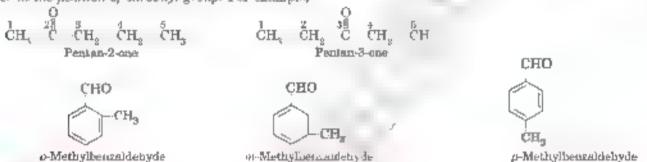
ISOMERISM IN ALDEHYDES AND KETCHES

Aldehydes and ketones show the following types of isomerism:

 Chain learnerism. Higher aldehydes containing four or more carbon atoms and ketones containing five or more carbon atoms, abow chain isomerism in which the somers differ in the chain of curbon atoms.



Position isomerism. Higher ketones and aromatic adeliydes exist it position isomerism in which the isomers
differ in the position of carbonyl group. For example,



NOTE

Auphatic aidaliydes do not show position, somerism because. LHC group is always present at the end of carbon chara-

ii. Functional isomerism. Aliphatic aldehades and ketones are the functional isomers of each other because they have same molecular formulae but different functional groups. For example.

CH₃ CH₂—CHO CH₃ C—CH₃
Propenses

Aldehydes and letones are functional womers of each other

 Metamerism. Ketones show metamerism in which the isomers differ in the alkyl groups around curbony's group. For example,

CH_CH_CH_CH_CH_ CH_CH_CO CH_CH_B
Pentan-2-one Pentan-3-one

Practice Problem?

Give IUPAC names of the following:

Ags. o S-Methylhexana. b 6-Chloro-3-ethylpentan-2-one . 3-Methylbutan-2-one d' 4-Chloroscatophanone e 2-to-bromopheny ethanal f 4-Hydroxy-2-methylbenzaidebyde g) 2-(8-exopentyl)-cyclohezannoe (h, 2-Ethylhez-2-enar 2. Write IUPAC and common names for the following (a) H_aC = CHCOCH_a (b) HOCH CH CHO a) (CH, CCHO Ans. a 2 2-Dimethylpropansi a a-Dimethyl propionaidehyde 3 Hydroxypropana. B-Hydraxy proposaldelwde but-8-en-2-one, methyl vmyl ketone Give the structures and IUPA "names of isomeric and hydre having molecular formula C.H., O Ama. Four momers. Cave the structures and ITPAC names of all the carbonyl compounds having the molecular formula. "He. Ans. Three isomers. Give the formula of stat) metamar of CH, CH, COCH, CH, Ans. PH, NORH, PH, a CHICOCHICH, CHI CH,COCH,CH,CH, Draw the structures of the following compounds a 6-Methylbutanal b 4-Chioropea.an-2-one c 4-Mothylpent-3-en-2-one d) p-Methyl benzaidehyde (A.1 B.B. 2010) CHO Ans. .a CH_CHCH_CHO Name the following compounds are unding to TUPAC system of minienclature a) $CH_{*}CH = CHCHO$ OH, OHOCH, INFLOH, CHO. tel OHCC, H, CHO-p

METHODS OF PREPARATION OF ALDERY ES AND KETONES

Some of the general methods of preparetion of albehydes and ketones are discussed below

A Methods of preparation for both Adehydes and Ketones

1. From Airohols

(a) CH_COCH_GO CH_

Ans., a But-2-ensi.

d Penjane-2 4-dional

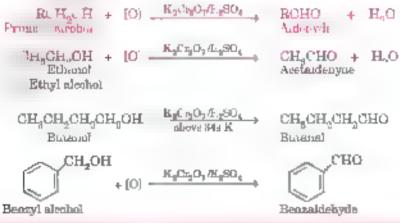
(a) By exidation. At selly less cances prepared by the excitetion of premary absolute with normal exidence agents such as aciditied potassium dichromate. (K₂Cr₂, z₂ potassium permanganate. kMox. z₃, chromium exide. CrO₃) and sulphuric serd

(a) CH_CH_COCH(C,H_JCH_CH_C

e 3-47 hors-1-ethylbeann-3-one

c) Benzene-1, 4-dicarbaldehyde

(b) 4-Methylpentanal



Aidehydea undergo readily exidation to carboxylic acids. Therefore, to provem further oxidation of aidehydes, these are distilled off as soon as these are formed.

The ancohols can be converted to and chydres stage by treating with randising ages: pyridinium chlorochromate $C_3H_4NH^*$ or $_{g^{\pm}}f^{\pm}$ known as Corey's reagent at a abbreviated as PUC, and a formed when Crt $_3$ dissolved in hydroch one and as treated with hydrochromethras

This reagens is used in non-aqueous solver is like ${}^{1}H_{n}{}^{2}L_{n}$ behave the three This is a very good reagent because it checks the further modelion of aidebydes to carboxybe ands ϵ .

It may be noted that Pt., also does not attack carbon-carbon double bond present in the molecule

Ketones can be prepared by the condation of secondary accounts with similar condizing agents.

$$\begin{array}{c} \text{CH}_{b} \\ \text{CHOH} + [O) \\ \text{CH}_{b} \\ \text{Isopropyl alcohol} \\ \text{CH}_{3} \\ \text{CHOH} + [O) \\ \text{CH}_{3} \\ \text{CHOH} + [O) \\ \text{Sor Butyl alcohol} \\ \text{Sor Butyl alcohol} \\ \text{OH} + [O] \\ \text{CH}_{3} \\ \text{CH}_{2} \\ \text{C}_{3} \\ \text{C}_{3} \\ \text{C}_{4} \\ \text{C}_{5} \\ \text{C}_{6} \\ \text{C}_{7} \\$$

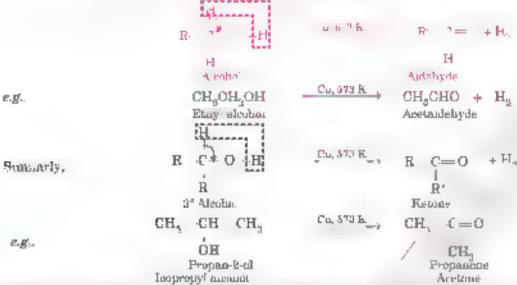
Kelones are not easily andised to their and can therefore, be obtained in high yield by his method

The use of CrO_3 in a pieces accurate is is notify collect Jones oxidation, or exidation by Jones reagents. This also does not affect double bond in the molecule.

Because of the toxicity of reagents that contain chromium, a new method has been developed called

Swern-existence at asses dimethylendphonde. $CH_{n,n}St$ (EMSO) exally change $|OCI| \begin{bmatrix} O & O \\ I & || \\ C & C & C \end{bmatrix}$ and triethylendine. The exidation of primary another stops at the aldehyde and secondary anothers are excised |OCI| = |OCI|.

(b) By the catalytic dehydrogenation of alcohols Aidebydes and kelones can be prepared by the dehydrogenation of alcohols. It is carried out by passing the vapour of alcohol over reduced copper at 578 K. Primary alcohols give aidebydes white secondary alcohols give ketones.

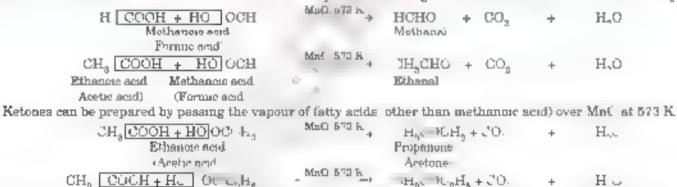


It may be noted that tert-aicohols cannot be dehydrogenated to get aldehodes or ketones because they do not have u-hydrogen. With Cu at 678 K, they get dehydroted to form alkenes orefer Chapter 11.

2. From Carboxylie Ands

Ethanore scul

a Aidehydes and kelones can be prepared by calculytic decomposition of carbodylic scale. This can be done by heating a mindure of methanoic acid or other acids to 573 km are presence of manganous scale. MnO, which acts as a catalyst.

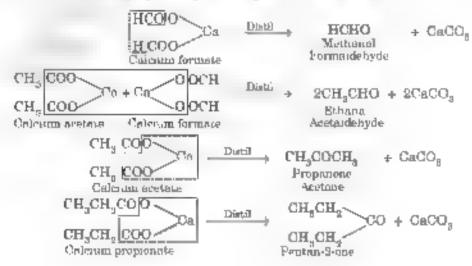


Butent-9-one

If one of the two scids is methanoic acid, then aldehyde is slwsys obtained otherwise ketones are formed

Руарвание вемі

b Aidehydes and ketones can also be prepared by distaining the calcum sains of the acids. For example.



This method is, however not very suitable for the preparation of aidenydes, except formaidehyde, because the yield is very low. This is because when a mixture of two calcium sails is heated three products are formed. For example, dry distribution of a mixture of calcium formate and calcium acetale gives a mixture of formaidehyde, acetaldehyde and acetone. Similarly, this method cannot be used for the preparation of analymmetrical ketone because it gives a trigiture of three ketones. For example, try distribution of a mixture of calcium acetate and calcium proposate will give a mixture of acetone, bullanous and 8-pentanous.

Cyclic ketones are formed when case im saits of dicarboxylic acids are heated. For example,

8. From hydrocarbons

(a) By bydration of alkynes. Aldehydes and ketones can be prepared by the hydration of alkynes in the presence of di. H.SO₊ and HgSO₊ as catalyst. Water sods to alkynes in form unstable eros sutermediates which rearrange to form sudehydes or ketones.

Formatdehyde cannot be prepared by this method

(b) By hydroboration-exidation reaction. The alkynes can be converted into adelydes and ketones by hydroboration- oxidation in jet on Borane adds to an alkyne forming uniphe borane, which on andmion with H₀O, gives aldenydes and ketones. The symmetrical non-terminal alkynes give a single ketone while unsymmetrical non-terminal alkynes give a give a anxilic of both possible ketones in which the methyl ketones predominate.

$$CH_{3} \quad C = C \quad CH_{3}CH_{3} \quad \stackrel{B_{3}L_{3}}{\longrightarrow} \stackrel{Timp}{\longrightarrow} \quad CH_{3} \quad C \quad CH_{4} \quad CH_{2} \quad CH_{3} \quad + CH_{3} \quad CH_{3$$

Term nall alkynes give a dehydes. However, to avoid complication due to double bond addition of disorane, bulky stearcally bindered boranes such as bis 1, 2-dimethy, propy-borane commonly known as **disiamylborane**, R_pBH_p to shortened version of disorane borane is used in place of abborane.

$$CH_{\zeta}CH_{2}CH_{2}C = CH \qquad \xrightarrow{R_{2}BH} \qquad CH_{\zeta}CH_{2}CH_{2}CH_{2}CH_{0}$$

$$Pento angle \qquad Pentonal$$

$$Here R_{z}BH = demant yiborane \qquad CH_{\zeta}CH_{2} \qquad CH \qquad CH \qquad BH \qquad CH_{0}$$

It a very a teresting to note that indroboration exidation method in a unidementary to the direct Hg²⁺ cota, yaed hydration reaction of terminal alkynes because different products are obtained. Hydration of terminal alkyne with Hg salt and water gives methyl ketone whereas hydroborationess is in infinite same terminal alkyne gives aided yie.

(c) By asonolysis of alkanes. Alkanes react with ozone to form ozonide which on subsequent desvage with zinc dust and water gives aldehydes and ketones.

$$C = C + O_8$$
 \rightarrow $C = + = C + H$, $C = O_8$ \rightarrow O_8 \rightarrow O_8

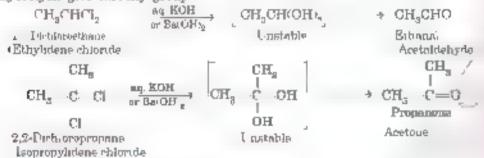
It is clear that if the carbon forming the double bond carries a H-atom attached to it, aidehydes are formed otherwise kelones are formed. For example,

(d) By Wacker's process. Alkenes can be converted to atdehydes and ketones by treating with an acadified aqueous solution of patiodicini chimide. PdCL containing a cata, whe amount of a process on the PdCL, a the presence of air or oxygen. This method is known as Wacker's process.

$$\begin{array}{ll} \mathrm{CH} \ \mathrm{CH} = \mathrm{CH}_a + \mathrm{PdCL}_3 + \mathrm{H}_4\mathrm{O} & \stackrel{\mathrm{folt}_3}{\mathrm{An ur}} \stackrel{\mathrm{H}_3}{\downarrow_2} & \mathrm{H}_3 \oplus \mathrm{Ur}_3 + \mathrm{Pd} + 2\mathrm{HCr} \\ \mathrm{Propens} & & \mathrm{Acetone} \end{array}$$

4. From Gem Dihat.des

The gene shandes, containing two hologen atoms on the same carbon atom on hydrolysis give carbonyl group.



B. Methods of Preparation of Aldehydes only

1. From Acid Chlorides

a Acadich ordes are converted into adeliydes by cotalytic hydrogenation to the presence of paliedium. Pd. cotalyst supported over barriam sulphole. The catalytic that are is poisoned by the addition of a small amount of soly, or or a moune. This reaction is known as Resembled for perion.

Role of capric chloride catalyst

Durning the reaction, Pd (II us reduced to metalisc Pd, which is meffective for aubsequent craneformation. Since PdCi. as as expensive reagent it is better to use an external oxidising gent to convert Pd to Pd IJ oxidat on state so that the reaction continues. The function of CuCl, is to rempdise Pd to Padia, which is reused. During the process, CuCl_p is reduced of Co. I claimtor which to swelf reoxidised back to Cucil, by oxygen so that it becomes ready to omdise more paliadram.

$$Pd + 2CuCl_2 \rightarrow PdCl_2 + 2C_1C1$$

 $4 CuCl + 4HC + 0. \rightarrow 4CuCl_1 + 2H_1O$

Formulably de cannot be proported by this method because a strong pounding and chloride form we characte HCOCs is unstable at room temperature.

Function of poisoning of catalyst. Normally aldehydes are further reduced to primary alcohols. Therefore, in order to prevent the further reduction of aldehydes, the catalytic mixture is poisoned descrived by addition of sulphur or quinoline. This courses are reaction at aldehydes only

Alternatively, and chlorides can be converted into aldehydes by hthrum tri-fert-butoxyaluminum bydride (LaA.H(O-t-Bu)₀₊ at 195K v 78° C)

where LiAiH(O-t-Bu)₃ is LiA₋₁OO(CH_{3/8}I

Η

2. From Reduction of Alkyl Cyanides (or natriles) and esters

Alkyl cyanides for articles) when reduced with standaus chloride and hydrod; our acid in absolute ether followed by aydrogais give aidehydes. This reaction is known as Stephen reduction.

Ketones cannot be prepared by this method

Alternatively intriles and esters can be reduced with mild reducing "gents such as a sobuty alumno an hydride (DIBALH) to immes which on hydrolysis gives aldehydes.

Ĥ

Similarly esters are reduced to aldehydes with DIBALH at low temperature 78°C).

2. From aromatic hydrocarbons

Aromatic aldehydes (benzaidehyde and its derivatives) are prepared from aromatic hydrocarbons by the following methods

(a) By exidation of methyl benzene. Strong widtsing agents such as saidified or alkaline $KMnO_{\gamma}$ and fied $K_{\gamma}Cr_{\gamma}O_{\gamma}$, cond. HN I_{γ} etc. exidate toluene and its lenviatives to benzed and through the exidation of intermediate ordenyoes.

However it is possible to supplie conduction at aldehyde stage with suitable reagents which convert the methyl group to an intermediate that is sufficially to exide further. The following methods are used for this purpose

(f) Use of chromic exide in acetic anhydride. A omain aldeliydes are prepared when a ky is is chain in aromatic ring is exclused using chromium thouside int, and acetic anhydride. The adeliyde formed immediately gets acetylated with acetic or hydride forming gets discente and this does not get first er madised. Therefore, the fraction of acetic anhydride is to preven, further exidation of the aideliyde to each. The gets discense formed is isolated and hydrolysed with aqueous and (di. HC) or di. H₂S_{1-x} to give corresponding aromatic aideliyde. For example

Similarly, p-nitrotoluene gives p-nitrobenzaidehyde (45% yield).

It may be noted that the further oxidation of benzalde syde to benzoic and is prevented by trapping the aldehyde as gent-draws are with accretic anhydride. The gern diagetals cannot be further oxidised.

Use of chromyl chloride. Alkyl beazenes can also be oxideed to benzaldebyde with a solution of chromycharate $CrO_nC_n = a_nCC_k$ or CS_n . A brown chromium complex is formed which is decomposed by water to give corresponding benzaldebyde. This reaction is called **Light reaction**.

Tologoe

Brown chronism complet

Benzeldebyde

In case the aide chain contains group higher than -CH₃ group, the end carbon atom of the chain is oxidized by CrO₀Cl₃ to -CHO group.

(III By side chain chlorination followed by hydrolysis. Side chain chlorination of toluene gives benzal chloride, which on hydrolysis gives benzaldehyde.

This is a commercial method used for the manufacture of benzaldehyde.

(it) By Gattermann Koch reaction. Bettarne or the enviatives are converted to benzaldehyde or substituted benzaldehyde by treatment with carbon monoxide and hydrogen chioride in the presence of anhydrous Alting or cuprons chiorine scatalysts.

This reaction is known as Gatte-mann Rock react on

Gattermann aldebyde synthesis or Gattermann formylation.

If A in the Intermonn Keet aldebyte symmetric is replaced by H. N the browns succeeds through the reaction is called Configuration all the less to be use or as erronous formal lettern. This reaction proceeds through the formation of name intermediate which under the community of the reaction is bymotysed to the aidebyde.

For example, when renzerion and sted with a mixture of Ho"N and HC" gas to the presence of ambydrous AICI_p, benzeloubly is a formed

From hydrocyanic and

Aldehydes can be prepared from hydrocyanic acid on treatment with Crignard reagent and subsequently followed by hydrolysis gives on aldehyde

$$H- \ \ = N + CH_gMgBr \xrightarrow{Dry\,ether} CH_g - C = NMgBr \xrightarrow{H^*_g \hat{U}} CH_gCHO + NH_g + MgcOH Br$$
 Hydraxyanac acid Adulton product Acetaldebyde

5. Reimer-Tiemann reaction

Fhenche aidehydes are obtained by treating the phenol with chicroform in squeous sociam hydroxide solution at about 348 K. This reaction is called Reimer-Tierrann resection.

C t Methods of Preparation of ketones only

1 From acyl chlorides

Ketones can be prepared from acyl chlorides by treating with dislikyl cadmium. The dislikyl cadmium needed for this purpose is prepared by the reaction between Grighard reagent and as by rouse cadmium characters.

It may be noted that Grignard reagent RMgX cannot be used in place of dialkyl radioium. This is because the ketone formed would further react with Grignard reagent to give a tertiary atcohol.

Propanone formed further reacts as

Addition product 3-Methylpropen-2-ol ,3%

On the other and dialky codarian is weather than Granord reagen, or I was no tempera in react with ketone Therefore in the radio on a used for the property on if belongs a preference to Granord reagen

Benzonitrale

2. From nitriles by Grignard reagent

Both suphatic and aromatic ketones can be prepared by treating an alkyl or aryl nitrile with suitable Grignard reagent followed by acid hydrolysis. For example

1 Phenylpropanoue can also be prepared by the action of ethyl magnes or brounds on benzomtrue followed by acid hydrolysis.

It may be noted that if hydrocyanic acid $H^{*}N$ is used noted of sikyl or anyl mixile in the above reaction aidehydes are formed (already discussed).

Aretophenone

From henzege or substituted began to by Friedel Crafts reaction.

Addition product.

Aromatic ketones can be prepared by Fundel Crafts acylation or benzoyintion by treating aromatic hydrocarbons with acid chiorides in the presence of a Lewis acid, ike analydrous all minimum chioride.

Friedel Crafts reaction is a typical example of electroph tic substitution reaction.

Benzophenone can also be prepared by Friedet Brafts react, in of earbonylich, made phosgene, with excess of benzene

4. From phenyl esters by Fries rearrangement

Phenom esters or pheny esters pheny acetate phenyl benzoate, etc.) on tenting with an ydrous AC_g in the presence of CS_g as solven, undergo a rearrangement in which the acyt acetyl benzoyl, etc. group migrates from

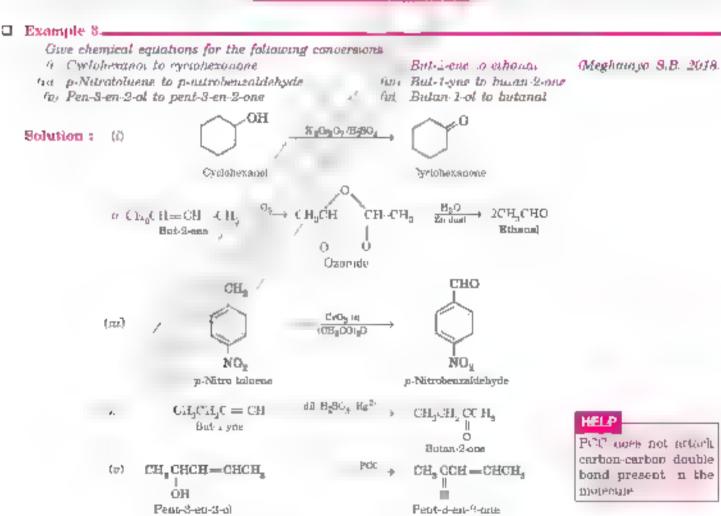
ALDEHYDES KETONES AND CARBOXYLIC ACIDS

the phenolic exygen atom to the p-and p-positions of the benzene ring to give a mixture of p-and p-phenolic ketimes (or hydroxy ketimes)

This reaction is called Fries reorrangement

It may be noted that in this rearrangement reaction, presomer predom wites at lower temperature, 390 K or eas whereas or somer predominates at high temperature, 430K or a low of the sterio effects.





CARANHT CACACIT

UPC(C)

CH_CH_CH_CHO

Butanni.

CH_CH_OH_OH_OH

Button-1-ol

.017

Example 4.

Suggest the reagents to bring about the following conversions

% Hexan 1-at to hexanat

(ii) Cyclohesanol to cyclohesanone

tra 4-Fluorotomene to 4 fluorobenzatdeliyde

io Ethanen trite to ethanas

· Alayl alcohol to propenal

in But-2-ene to exhausi

N.C K.R.T.

Solution:

- (t) O₆H₆NH*CrO₅ClT(PCC) in CH₀Cl₅
- (a) K₀Cr₀O₇ in acidic median
- or the presence of oretar anhydride 279, 283K, or Trickitt, Hall
- (a) DiBALH Discoutyl alummum hydride. 78°C, H.O*
- e) PCC in CH,Cl,
- en) O_o/H_oO—Zn dust

Practice Problems

- 8. How are the following compounds prepared?
 - a) Benzaidehyde from benzoyl chloride
- (b) Aretophenone from benzeue
- (c) Acetone from appropyl alcohol
- (d) Aretone from propyne.
- 9. Name the alkene which on reductive ozonolysis gives only sectime.
 - Ans. 2, 9-Dimethylbut-2-ene
- Complete the following reactions:

11. How will you obtain the following?



PHYSICAL PROPER TES OF ALDERYDES AND RETONES

The important physical properties of aldehydes and ketones are given below

1 Physical state. Met, and is a pungent smelling gree Ethana. Is a volative liquid, bip. 204 K. Ther aldehydes and ketnies containing up to eleven carbon atoms are conordess regards while still higher members are souds.

2. Smell. With the exception of lower of lehydes which have impressent ido as anomydes and ketones in vergenerally pleasant smell. As the size of the indicatile increases, the idoi in becomes less purgent and more fragment in fact, many nationally occurring adeliyees and ketones have been used in blending of performes and flavouring agents.

8. Solubility Aidehydes and ketones apt: four carbon atoms are miserile with water. This is due to the presence of hydrogen conding between the polar carbonyl group and water in certies as shown below.



However, the armitality of aide tydes and ketones decreases rapidly on increasing the length of sikyl chain. As a result, the higher nemicers with more than four carbon atoms are practically insomble in water. All aidehydes and ketones are fairly so this in organic solvents such as benzene, ether, chi poform, alcoholiets. The ketones are good solvents themselves.

4. Boiling points. The boiling points of aldelly designed Retones are higher than those of non-polar compounds (hydromidians) or weakly polar compounds such as ethers) of comparable molecular masses. However, their boiling points are liver than those of corresponding archois or carboxylic across this is because aldehyder and ketones are polar compounds having a different inversion estalar dipole-impose interactions between the apposite ends of C = C dipoles.

However, these dipole-dipole interactions are weaker than the intermolecular hydrogen bonding in alcohols and carbodylic scids. Therefore, boiling points of aldebydes and ketones are relatively lower than the alcohols and carbodylic acids of comparable molecular masses.

Compound	TH _a TH _a CH _a CH _a CH _a Butana	f H _a (H _a)f H _a Methoxyethane	iH _a , H _a , H _a , H Propensiso	CH _a , 'H _a , 'H _b Propone'	CH ₅ Port H ₅ Propances
Molecular mass	60	60	80	88	68
Boiling point K	273	20.	970	322	320

Among the curbonyl compounds, ketones have slightly bigher botting points than the (someric aldehydes. This is due to the presence of two electrons releasing groups around the carbonyl carbon which makes them more polar

Example 6...

N.CER.T

So, after 1 The indecinar masses of trees compounds are comparable $CH_3CH_2CH_4CHO = 72$, $CH_3CH_3CH_4CH_5CH_4CH_5CH_4$, $C_3H_3 = 70$. $C_3H_3 = 70$. $C_3H_4 = 72$. Among these compounds, but $m_{*2} = 0$. $CH_4CH_3CH_3CH_4$, $CH_4CH_5CH_5CH_5$, $CH_4CH_5CH_5$, CH_4CH_5 , CH_4 , CH_4CH_5 , CH_4 , $CH_$

CHEMICAL PROPERTIES OF ALDEHYDES AND KETONES

The chemical properties of aidehydes and ketones are due to the carbonyl group present in their moterales.

Structure of Carbonyt Group

The carbon vi carbon is sp^n tybridised and therefore earbon has three sp^n hybrid irbitals and one unhybridised p orbital. It sees sp^n tybrid orbitals to form three sigms roads, one with exygen atom: of CO group and other two with two other atoms or groups. Here R_n All these three sigms bonds be in one plane at an angle of 120^n . The unhybridised 2p-orbital of carbonyl carbon forms n-bond with exygen atom by overlapping sidewise with half-filled 2p-orbital of oxygen atom. The exygen atom has two lone pairs of electrons which occupy the remaining two orbitals. Thus, the carbonyl carbon and three atoms attached to the in the same plane and the n-electron cloud is above and below this plane.

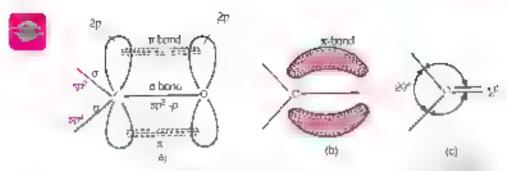


Fig. 1. Orbital picture of carbonyl group

The mygen from in the carbonyl group is more electronegative than carbon stome electronegativity values C = 2.5. C = 3.5. As a result, tayget at int tends a attract the electron of the E to E bound towards terif and therefore it acquires a small negative charge and carbon becomes slightly postately charged. Thus the carbonyl bond may be represented as

Hence, the carbonyl carbon is an electrophilic Lewis scid; and the carbonyl oxygen behaves as nucleophilic (Lewis base).

The polar nature of the carbony' group is supported by the first think in ellydes and kerones have large dipole moments between 2.3 I to 2.8 D. For example, the dipole moments of ethans, and propanous are 2.72 and 2.88 D. respectively. The high polarity of carbony, group is explained on the basis of resonance between the following neutral (a) and dipolar (b) structures.

Differences between C=C and C=O bonds

The ethyleric double band C=C differs from carbony group C=C in the following ways

Halogens balogen acids and H_iSt_{ij} undergo and more reactions, with ethylenic double bond but not with carbonyl group.

Ethylenic double bond undergoes exchraptalic addition reactions while $\mathcal{L} = C$ bond undergoes nucleophiac addition reactions.

Reasons. The main reasons for the differences in the two types of bonds are

Curbony group a point in the waite engineer could be bossed a non-polar.

The carbony group shows resonance who eithere is no resonance at case of ethy end doubte cond.

The resonance structures of carbonyl group are

Reactions of Aldehydes and Ketones

Aldelydes and ketones are taken reactive compounds. Since both aldelydes and ketones have the carbony functional group, they undergo annuar chemical reactions. The reactions of aldelydes and ketones can be discussed in the following categories.

- A. Nacleophitic addition reactions
- B. Nurrecalls so addition reasons followed by elim artion of water materials
- C Oxidation reactions
- D. Reduction reactions
- E. Miscelianeous reactions

A. Nucleophilic Addition Reactions

The adehydes and ketones undergo nucleophilic addition reactions. The carbonyl group is highly reactive polar group. It is polarised fac to the higher electronegal with of oxygen in comparison to car on. As a result, the electrons between carbon and oxygen are more lowerds oxygen atom. The actual structure may be represented as

Consequently the carbonyl carbon is positively charged while the oxygen is negatively charged. Therefore, a modern life of the zero attacks the electrophilic carbon atom cross livery charged of the poter carbonyl group from a direction approximately perpendicular to the plane of the sp^2 hybrid sec orbitals of the carbonyl group. Fig. 21 During this process, the π -electron pair between C and O gets transferred to the oxygen atom. This gives rise to an intermediate having a negatively charged oxygen. The hybrid salion of the carbonyl carbon changes from sp^2 to sp^2 and a tetrahedral alkohide intermediate is formed. This intermediate, then picks up a H* from the medium or other part of the reagent to give the electrically neutral addition product. The net result is the addition of nucleophile and H* across the carbon mayon double bond.

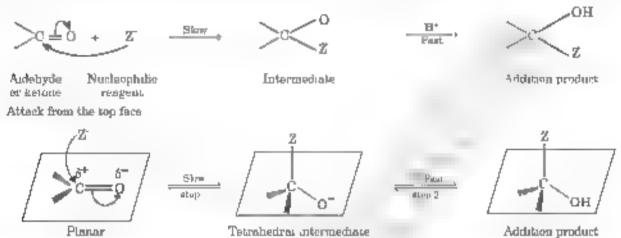


Fig. 2. Nucleophilio attack on carbonyl carbon

If the ottacking nucleophiles are weak e.g., aminous names derivatives, the reaction of sidehydes and kesmes are used by corned out to the weakly acrise medium. So the reactions are caused acid catalysed nucleophilic addition reactions.

Actit catalysed addition reactions. Many reactions of rarbin, yt groups involve an initial protonation of the exygen in *weakty action medium*. The protonation increases the positive charge of the carbonyl carbon so that it is more readily attacked by weaker nucleophiles.

The nucleophile, then attacks the protopored carbonyl group to form addition product.

Therefore, the reactions is linear adelydes and ketanes and weaker autreophiles are carried out in weakly acidic medium.

Relative Reputivity of Aldehydes and Ketones

Alderlydes and ketones remaly undergo nucleophs is addition reactions. However, ketones are sets reaction than aldehydes. This is the to electronic and steams effects as explained below.

1. Inductive effect. The relative reactivities of alderedes and ketones in nucleophilic addition, reactions may be attributed to the amount of positive charge on the carbon. A greater positive charge means a higher reactivity. If the positive charge is inspersed throughout the molecule, a the rarbony compound becomes more stable and its reactivity decreases. Now asky group is an electron releasing group #1 additive effects. Therefore, electron releasing power of two askyl groups in ketones is more than that if one in aldehyde. As a result, the electron deficiency of carbon atom electron marry) in the carbony group is satisfied more in ketones than in addehydes. Therefore, the reduced positive charge on earbor in case of ketones discourages, the attack of micleophiles. Hence electron marry betones are less reactive than addehydes. Formaldehyde with no alkyl group is the most reactive of the aldehydes and befores. Thus, the order of reactivity is

2. Sterie effect. The size of the alkyl group is more than that of Lydrogen. In aidelydes, there is one alkyl group but in keiones, there are two alkyl groups attached to the carbonyl group. The alkyl groups are larger than a hydrogen atom and these cause hindrance to the attacking group. This is called steric hindrance. As the number and size of the aikyl groups, acrosses, the hindrance to the attack of madeophile also increases and react into decreases. The tack of hindrance to markeophilic about a smoker reason for the greater reactivity of formuldehyde. Thus, the reactivity follows the order.

Arometic Aldehydes and Ketones

In genera, aromatic aldehydes and ketones are less reactive than the corresponding alighatic analogues. For example, benzaidenvide is was reactive than ampients mountedes. This can be easily understood from the resonating structures of benzaidehyde as shown below

It is clear from the resonating structures that die to existing releasing +Leffect of the benzene ring, the magnitude of the positive charge on the carbonyl group der relates and consequently it becomes less susceptible to the nucleopalite attack. Thus, aromatic adenydes and ketones irrelated the corresponding an phatic aldehydes and ketones. However, amongst aromatic adehydes and ketones aromatic aldehydes are more reactive than diaryl ketones which in turn are more reactive than diaryl ketones. Thus, the order of reactivity of aromatic adehydes and ketones is

SOLVED EXAMPLES

Example 6...

Arrange the following carboning compounds in the increasing order of their reactivity in nucleoph he addition reactions

- (i) Ethanol, proponal, proponone, butanone
- ir Berwaldehyde, p-towardehyde, p-nitrobenzaldehyde, acetophenone

Tripura S.B. 20.0

Sr ution — The electron donoting inductive effect and steric crowding around carbonyl group increases in the given order. Therefore, the reactivity decreases in the order

Ethanal > Propanal > Propanone > Bolamme

 C^* Among these arctophenone is between and therefore, it is least reactive p-Toloridelyde, we an electron releasing CH_s group at the para position of the benzene ring whereas p-intro-benzaidelyde has electron withdrawing c NO_s - group at paraportion. Therefore p-toloridelyde is less reactive and p-intro-benzaidelyde is note reactive than benzaidelyde. Thus, the order is Austriphenone < p-toloridelyde < p-notrobenzaidelyde.

■ Example 7=

Would you expect ben, additive to be less or more reactive in nucleoph in add than reactions than propaga! I Explain.

Solution. The carbon atom of the carbony group of benzaidehyde is less electrophilic than carbon atom of the carbonyl group in the proponal. This is because the polarity of the carbonyl group is decreased in benzaidehyde due to resonance. Therefore, benzaidehyde is less reserve than proponal.

SOME IMPORTANT EXAMPLES OF NOTHER PHONG A DOTTON REACTIONS

Some important nucleophilic addition reactions of aldehydes and ketones are given delow

 Addition of hydrogen cyanide. Both aldebydes and ketones react with hydrogen cyanide to form addition products known as cyanobydrins. For example,

It may be noted that the reaction occurs very allowly with pure HCN. Therefore, the reaction is carried out in the presence of a mase which acts as a many to The hone removes a proton from hydrogen cyanide or 1 reachly produces CN none and makes the reaction fast.

In actual practice, H. N needed for the purpose is produced in sun by the action of dilute mineral acid on codum cyanide.

The reaction is believed to proceed as follows. The positively polarised carbon of carbony' group is attacked by strongly uncleophilic. No with the simultaneous transfer of n-electrons to oxygen. The oxygen then combines with H* to give the cyanoliydrin.

Cymolydro's are useful compounds a organic synthesis. These can be used to prepare o'may other organic compounds such as ti-hydroxy ands. c., \$-insaturated ands. am. no acids. etc.

On subsequent besting facts and in the presence of $H.So_4$ gives scrybe and (ii, β -unsaturated and).

CH₃ -C OH
$$\xrightarrow{\text{Rest}}$$
 $\xrightarrow{\text{Heat}}$ CH₂=CLCOOH

COOH $\xrightarrow{\text{Acrylar acid}}$ $\xrightarrow{\text{Acrylar acid}}$ $\xrightarrow{\text{Acrylar acid}}$ $\xrightarrow{\text{Acrylar acid}}$

Cyanohydrina can also be converted into anino acids.

Cyanohydrin can be reduced with LiA.H, to give β-amino alcohola.

Similarly, cyanohydrun formation of benzaidehyde gives different products.

2. Addition of sodium bisulphite. Both adehydes and ketones form crystal me addition compounds called bisulphite adducts when treated with sate set ours of sodium basilpante. For example

The reaction involves the nucleophilic attack of bisulptute (HSO_{γ}) on the polarised carbonyl carbon atom followed by proton transfer and combination with Ns^{+} ion as:

It may be noted that the position of equilibrium see largely to the right for most aldehydes and to the left for most keepines due to steam reasons. The obstipline addition products of adehydes and ketones are crystalline so this and are water solulite. As the reaction is reversible, the addition products can be decomposed by immeral ands or aqueous alkanes, o give back the original anothyde or keighe. Therefore, the reaction can be used in the purification and separation of aldehydes and ketones from other non-carbonyl compounds.

It may be noted that the compounds such as diethyl ketone, acctophenone, benzophenone, etc. do not undergo this reaction. This may be probably due to the steams hindrings of the broke groups present around the carbonyl group.

8. Reaction with Grignard reagents (RMgX). Aldehydes and sections react with Grignard reagents to form addition products. When the aldition product a hydrolysed by water in gives alcohols.

Formaldehyde produces primary alcohols, other aldehydes g, w secondary alcohols, wh le ketones gov tertiary alcohols as illustrated below

The react, in is beneved to proceed by the nin inlinitiank of R manifeopinie on the positively charged curbon of the carbonyl group.

In these reactions, the sikyl or anyl group of the Grignard reagent is transferred to the carbon atom of the carbonyl group.

Thus Grighers reagent addition provides a useful reaction for the preparation of different alterials as shown below.

R, R R" are alky, groups and may be same.

4. Addition of alcohols. Adehydes react with alcohols in the presence of dry HCl, gas to give gene disaktory compounds. These compounds are called anothels. The reaction takes prove as

In the first step, the addition of one molecule of sirobol to an a heliyde gives a hemicoetar. The hemiscetal contains both an other and sicohol functional group. It is an unstance compound and reacts further with another molecule of alcohol to form stable acetals.

Dry hydrogen chloride protonates the exygen of the carbonyl compounds and therefore, increases the electrophilicity of the carbonyl carbon for intercapt the nucleophilicity as wask of also house. Bry HC gas also absorbs the water produced in these reactions and therefore, drives the equilibrium in the forward direction. The above reactions are reversible and therefore, the occasion be decomposed by diffue mineral acids to give back the original addebytes.

If material of two molecules of monohydric alcohols, dihydric alcohols are used, then cyclic aceta's are formed. For example

Acetaldehyde ethylene acetal

Ketones do not form acetals with monohydric alcohols. However, they combine with ethylene glycol under similar conditions to form cyclic products known as ethylene glycol ketal (or cyclic ketals).

The above reactions are reversible. Therefore, the accusis and ketals are hydrolysed with aqueous mineral acuts to regenerate the aldelydes and ketones.

$$\begin{array}{c|c} CH_3 & C & CH_2 \\ H & C & H_2 \\ \hline Cyclic aretai & H_1O \\ \hline \end{array} \qquad \begin{array}{c} CH_3 \\ H & C = O + C_0H_5OH \\ \hline \\ Acetaidehyde \\ \end{array}$$

B. Nucleophilic Addition Reactions followed by Loss of Water

5. Addition of immonia derivatives. Additions and ketones react with a number of ammonia derivatives H.N. Z. in weakly acidic medium to form compounds containing carbon-natrogen double bonds with the elimination of water molecule. The reaction is reversible and is catalysed by and. The equilibrium favours the product formation due to the rapid Jellydration of the intermediate to form. Den Z. For example

$$= + \frac{1}{2} +$$

Some of these compounds are crystalone and are used for the characterization of sidebydes and ketones. The common animous derivatives and the products formed are given below.

Ammonia derivative	Group Z /	Product with RCHO
NH,OH	-OH	RCH=N∱H
Hydroxylamine		Охьше
NH,NH,	-NH _o	RCH=N'NH,
Hydrazios		Hydraxone
NH, NH	NH (RCH=MNH
Phenyl hydrazine		Phonyl bydrazone
NO ₃	NO.	√ NO₂
NH2-NH-NO2	NH NO2	$RCH = N'NH \bigcirc NO.$
4-Duntropheny hydrazne		2. 4-Dantsuphenyl sydrazone
NH_NHCONH,	NHCONH,	RCH = NNHOUNH
Sendeneberade		Semondazine

- Prof. Child to not sol and group addition of ammonia derivatives to aldehydes and ketones -

The authorial brivatives—or air a one pair of electrons and therefore their reaction with aldehydes and kerones involves the nucleophilic at ack by the basic autrogen compound on the carbonyl carbon. The authorial derivatives are weak nucleophiles and therefore, the reaction is cata used by weakly acidic inclum. The reaction occurs in the steps given below.

Step I. In scalar medium carbonyl mygen gets protonated

$$-E = 0^{\circ} + \frac{R^{\circ}}{\text{From and}} \left[\begin{array}{ccc} C \stackrel{\bullet}{=} \dot{O} H & \longleftrightarrow & \dot{C} - OH \end{array} \right]$$

Promised curtous, group

Step II. The summade derivatives in which are ultrugen more has a tone pair at electrons act as nucleophiles and attack the positively charged a chary' corbon. The formation of carbon-interagen, and results a positive charge on nutrogen atom.

Step 1.1 The intermediate formed in step II is anstable which loses a proton. He and water molecule to form a stable product.

These three steps may be summarized as

$$C = O \xrightarrow{\text{Step I}} + \left[\begin{array}{ccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \text{Aldebyde} \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[\begin{array}{cccc} \hat{\mathbf{C}} = O^{\dagger}\mathbf{H} & & \\ \end{array} \right] \xrightarrow{\text{Step II}} + \left[$$

Therefore at a conserved that the protonation of carbony caypea makes the carbon vicarbon more susceptible to nucleophilic attack and, therefore, we expect that the reaction will be favoured by both acidic medium. However, the wedir a should not be **highly nordic. T**his is because if the medium is largely actual, then the abusing a derivatives being basic in noture, may form their respective ammonium saids N*Fi, ZX...

These saits of ammonia derivatives cannot act as nucleophiles occurse of the lack of unchared electron pair Therefore, the reaction loss not occur. Thus, to correspond these control have to control the neutral strength of he medium i.e. pH. The opi man, pH of he medium should be be, win 8 and 4.

Some of these reachons are discussed below

Reaction with hydroxylamine (NH,OH) to form oximes

Cyclobexanone Reaction with hydrozine NH,-NH_o) to form hydrazone

$$\frac{CH_0}{H} > C = O \rightarrow A_1NNH \qquad \qquad \frac{CF_0}{H} > C = NNH_0 \rightarrow H_0C$$

Aretaldebyde

Acetaidenyde hydrazone Ethana, hydrazone

Acetone

Reaction with phenylhydrazine C_aH_aNHNB_a to give phenylhydrazone.

$$CH_0$$
 CH_0
 CH_0

NOTE

The reactions of aidehydes and kelones with ammonia derivatives give characteristic woulds have ag sharp me tang points which are often used for the characterisation of these eoumpomada.

Reaction with 2, 4-dimitrophonyl hydrazine to give 2, 4-dimitrophenyl hydrazone.

bydrazute

These products are yellow or crange or red coloured crystalline compounds-called DNP derivatives: and can be used for the identification of aldobydes and ketones.

Reaction with semicarbazide (NH_NHCONH_) to give semicarbazone

6. Reaction with ammonio. Aidehydes (except formaticulais) react with annuous to form aidelily de ammonia adducts.

$$CH_3$$
 $C = O + NH_3$ H NH_2 Acetaidehyde ammoone adduct

The adduct on warming with water decomposes to give an imune.



Formaldehyde reacts with ammonia t_{ij} form became the electronounce, CH_{ij} N, which is also known as urotropine. It is used as a medicine to treat urinary infections.

Urotropine

Hexamethylene tetrasmine

R U Curious,.

RDX has many rivilian and multary applications. What is RDX?

Nitrotion of principle under control ed conditions gives the well known expressive compound RFX. Research and Development Explosive).

Cyclotrimethylenetranitramine or cyclonite or RDX

Acetone reacts with ammonia to form diacetone amme-

$$\begin{array}{c} \text{CH}_3 \\ \text{CH}_3 \end{array} \rightarrow \begin{bmatrix} \text{CH}_3 \\ \text{CH}_3 \end{bmatrix} \xrightarrow{\text{NH}_2} \begin{bmatrix} \text{NH}_2 \\ \text{OH} + \text{H} \text{CH}_2 \text{COCH}_3 \end{bmatrix} \xrightarrow{\text{NLO}} \text{CH}_3 \xrightarrow{\text{NH}_2} \begin{bmatrix} \text{C} \\ \text{C} \\ \text{CH}_3 \end{bmatrix} \xrightarrow{\text{C}} \text{CH}_3 \\ \text{CH}_3 \\ \text{Acetone} \end{array}$$

Benzaldehyde reacts with ammonia to form hydrobenzamide

7 Reaction with primary ammes. Aldehydes and ketones react with primary ammes in the presence of a catalytic amount of an acta to form azomethanes known as Schiff bases.

RCHO + H_NR + R(H=N_R + H_0O)

Adebyde Primary amine Scluff'e base

$$C_nH_5CHO + H_nN_nH_5 + C_nH_5CH = N_0C_nH_A + H_0O$$

Benzaidehyde Andine Benzaianilms

Scluff's base

6. Reaction with phosphorus pentachloride. When anothly are lettones react with PCl_s, they form gent disables

$$CH_{a} = 0 + PCI_{b} + CH_{c}CI + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{a} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{c} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{c} = 0 + PCI_{b} + CH_{c}CHCI_{0} + PCCI_{a}$$

$$CH_{c} = 0 + PCI_{b} + PCCI_{a}$$

C . Oxidation Reactions

9. Oxidation of aldehydes and ketones

a Aidehydes differ from Returns in their axidation reactions. Aldehydes can be easily exid sed to carboxylor acids in treatment with common two origing agents like antirolated. $KMnO_{\perp} R_{2}Cr_{n}O_{\tau}$, etc. The carboxylor acids formed contain the same number of carbox atoms as the aldehyde.

The wason for the easy oxidation of aldehyde is the presence of a hydrogen what on the wirbony, group which can be son writed into. OH group without undergoing the clea tage of any other hand.

Ketones are not easily condised. However, under drastic conditions, e., with powerful condising agents such as conc. HNO₅, KMnO₂H₂SO₄ or K₂Cr₂O₂H₂So₄, at elevated temperatures, ketones undergo cleavage of carbon-carbon bond giving a maxture of carboxylic acids having less number of carbon atoms than the viginal ketone.

In case of unsymmetrical ketones, the recovere occurs a such a way has keto group stave preferentially as he smaller a ky group. This is known as Pope it's rule. For example, in the oxide the of persons, one the major

mode of cleavage is at in which the methyl group stays with the keto group as a town below

Thus, exidation reaction can be used to distinguish between aidehydes and ketones. The open of this test is that aidehydes are very reachly exidised not only by strong conditing agents like KMn τ_n , $K_n \cup \tau_n \cup \tau_n$ etc. but also by weak exidising agents like Februa's reagen. Februay of those Repeater's sound in the Under these commutations, ketones are not exidised by these reagents. Therefore, these tests can be used to distinguish aidehydes or ketones.

Tollen's reagent. Tollen's reagent is emmomada, solut, it of $AgNO_g$. It is prepared by adding NH_sOH solution to $AgNO_g$ solution that the precipitates of AgO first formed just gets dissolved. It has the formula $AgNH_s \xrightarrow{*} UH$. When on adelyde is needed with Tollen's reagent, the adelyde reduces is veroup, to meta by solver and o bright solver matron as produced on the inner side of the test table. The adelyde is conduced to corresponding carboxylate amon.

This reaction is also known as silver mirror test. The saver nurror formed indicates the presence of aldehydic group in the molecule.

Both aliphatic and arematic aidebydes reduce l'ollen's reagent. Ketones de not give this test-

Pehling's solution. Fehling reagent contains two solutions. Fehling solution A and Fehling solution B Fehling solution A is an aqueous solution of cooper sulphate and Feming solution B is alkaline solution of solution potassium tertarate. Rochelle sait. These two solutions are mixed in equal amounts before test. When an aldehyde is neated with Felting solution, a reddish brown precipitate of cuprous oxide. Cu_2C_1 is formed. A dehydes are oxidised to corresponding carboxylate amon.

Aramatic aldehydes, however, donot respond to this test. Ketones also do not give this test.

- Benedict's solution. This is an alkaline solution of capital Cufff, and complexed with citrate ions. It reacts
 in the same way as the February solution.
- (b) Oxidation with sodium hypobalite. He oform reaction. Adehydes and ketones having at least one methyl group maked to the carbonyl carbon atom re methyl ketones $\mathrm{CH_3CO}_+$ and aceta lenyde are easily oxidised by excess of his igen in the presence of alkahing. Bright, if it the presence of dil NaOH in socialith hypobalite. NaOX) to give haloform charoform, bromoform or adoform. For example, when the reaction is carried but with sodium hypothetic NaOI Cl_2 and recurs NaOH in vertice spit of indeform is produced. This reaction is also known as haloform reaction. For example,

Is may be noted that this sudation does not affect a perbon carbon double bond if present in the molecule

The haloform reactions can also be used to distinguish methyl ketones ($\mathrm{CH_{6}CO}$ -) from ketones.

For example,

$$CH_{0}CCH_{2}CH_{1}CH_{0}$$

Pentan-2-time

$$CH_{1}CH_{1}CCH_{1}CH_{3}$$

Pentan-3-one

$$CH_{2}CH_{3}CCH_{4}CH_{3}$$

No ppt formed

$$CH_{3}CCH_{4}CH_{5}CH_{5}$$

CH=C C-CH

NaOH

$$CH_{2}CCH_{3}CCH_{4}CH_{5}$$

No ppt formed

$$CH_{3}CCH_{4}CH_{5}CH_{$$

It may be noted that certain alcohols ethyl alcohol and secondary alrebols, which can be converted to acetaldehyde or methyl ketones, under conditions these for the cest also give a positive indoform test.

Due to the formation of reliew precipitate of iodoform in this reaction it is also known as iodoform test. It is used for characterisming a impounds containing CH_3CO+ group is any group such as CH_3CH+ which can be outdised to CH_3CO- group.

OH

lodoform test

Formation of veilow precipitate of udoform is used as a test for certain aldehydes and ketones which have methyl group winded a carbony group CH₂CO— or compounds that our form this group is exidation OH.

· Remember. The compounds containing

O OH | CH₃—C— or CH₃—CH— groups give **indoform test** (yellow ppt. with sq Na₂CO₃ and
$$L_2$$
 solution).

Therefore, indoform test helps to distinguish between !

1 0 0 F 0 R M T 8 T	Carbonyl compounds (CH _a —0—) Methanal (HCHO) and ethanth CH _a CHO Ethanal gives this test Ethanal gives dus test Penhan-Some Hhat CH _a CH _a CH _a and pentar Some CH _a CH _a COCH _a CH _a Pentan-2 one gives this test Acetophenone T _a H _a COCH _a and benzophenone T _a H _a COCH _a CH _a Acetophenone gives this test Benzaldehyde (C _a H _a COCH _a Acetophenone (C _a H _a COCH _a Acetophenone gives this test	Alcohols (CH ₃ —CH) Ethanol CH ₃ ·H.OH and rect of CH ₃ ·CH) Ethanol gives this ex Ethanol H ₃ CH of and propagation H ₃ H ₄ ·CH ₅ ·OH Ethanol gives this test. Propagate of gives this test Butan 2-01 of H ₃ ·CH ₅ ·CH ₅ ·CH ₅ ·OH OH Sutan 2-01 of H ₃ ·CH ₅ ·CH ₅ ·CH ₅ ·OH Butan 1 of H ₃ ·CH ₅ ·CH ₅ ·CH ₅ ·OH Butan 2-01 gives this test
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D. Reduction of Aldehydes and Ketones

Reduction of aldehydes and ketones. Aidehydes and ketones are reduced to a variety of compounds, under different conditions.

1. Reduction to sleohols

Adebydes and ketones on catalytic hydrogens for in the presence of Ni. Pt or Pd or chemically by complex metal hydrogens ich as bith un aluminate bydrole LiA. H₄ or societic wordlydride NaBH₄ give alcohole A dehydes on transfer give printity anothers and between give printity anothers and between give printing anothers.

For example.

It may be noted that of the above reducing agents H₂N₂ Pt or Pd. LaAlH₁ and NaBH₁ are very effective reducing agents. LaAlH₁ is much more reactive than NaBH₄. It not only reduces adehydes and ketones but also removes acids, and I chieff set, families, esters, here compounts as ear. However, NaBH₁ reduces only adehydes, ketones, and chieffes, askyl habdes, etc. It reduces esters very slowly while it does not reduce carboxylic acids at all. For example,

OH

$$\begin{array}{c} O \\ \parallel \\ CH_{a}CH_{b}CH_{c}COCC_{a}H_{a} \\ \end{array} \\ \begin{array}{c} CH_{b}CH_{c}CH_{c}COCC_{b}H_{b} \\ \end{array} \\ \begin{array}{c} O \\ \parallel \\ CH_{a}CH_{c}CH_{c}COCC_{b}H_{b} \\ \end{array} \\ \begin{array}{c} O \\ \parallel \\ O \\ \end{array} \\ \begin{array}{c} O \\ \parallel \\ \end{array} \\ \begin{array}{c} O \\ \parallel \\ O \\ \end{array} \\ \begin{array}{c} O \\ \parallel \\ \end{array} \\$$

However both LaAlH, and NaBH, do not reduce isolated curbon-carbon double bonus and double bonds if benzene rings.

However, in case of C, β , insaturated aldehydes and kerones. LiA, H_1 recovers in y C = 0 group, eaving C = C bond as such. But NaBH, reduces both the C = 0 and C = 0 bonds, giving a nexture of products. In this C = 0 reduction product predominates over the reduction product in which both C = 0 and C = C groups are reduced.

Countytic Lydrogenstian can reduce both the double bond and the carbonyl group simultaneously

In order to reduce additive a kerone selectively subout reducing carbon-carbon double bond in the same more delater range gent hydroborane kinds— \circ BBN has been suggested. This reduces the carbonyl group of unsaturated anotherwise in ketones with very large negree of selectivity. For example, HijNi controduce total C = C and C = C at contone religious while in BBN in residue only C = C group.

Ketones can also be reduced to corresponding secondary alreadole by nessing them with atomizana sarproposide in isopropyl alcohol.

$$\frac{R}{R} = O \xrightarrow{\{I \in H_{3} \mid I_{1} \in HO\}_{3} \in HOH} \frac{R}{R} \in HOH$$

Ketons 2" Alcohol

This reaction is called Meerwe in Poundorf Verley reduction. This resolution involves the transfer of a hydride ton. H.) from isopropyl alcohol to the carbonyl carbon of ketone.

2. Reduction to hydrocarbons

Aldehydes and ketones can be reduced to corresponding hydrocarbons by the following methods:

. Reduction with zine amalgam and cone, HCI— Clemmenson reduction

Cleumenser, red attor, is commonly used for aldehydes or ketones which are senso ive to takahes.

n Reduction with basic solution of hydrazine - Wolff Aishner is Justi a

In this method aldehyde or ketone is heated with a mixture of hydrazine and a strong base. KOH or potassium tert- butoxide) to 453-473 in ethylene glycol as solvent

During this reduction, aldehyde or ketone is first converted to hydrazone with hydrazone and then in treatment with a strong base it gets converted to hydrocarbons.

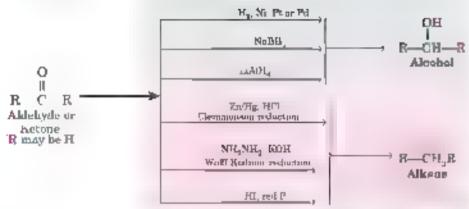
Reduction with HI in the presence of red phosphorus. A letydes and ketones are reduced to corresponding hydrocarbons by heating with HI in the presence of red F to 429 K.

3. Reduction to pinneols (bimolecular reduction)

Ketones on reduction with magnesium amnigam and water are reduced to symmetrical diols known as pinacols.

Aldehydes do not give this reaction.

Summary of reduction reactions

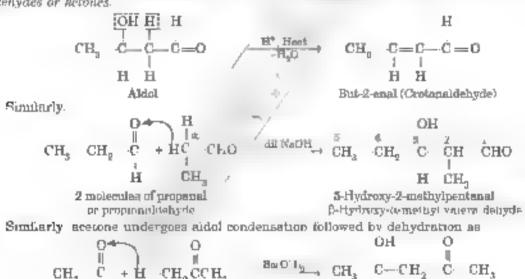


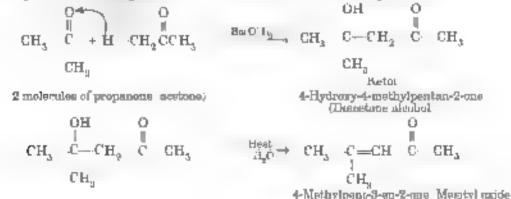
E. Miscellaneous Reactions

11. Aidol condensation. Aideliydes and kerones containing at least our anydrogen (Hartims attached to the C-atom adjacent to the carbonyl group madergo sed our leasation in the message of date a knot of form β-byarmay markyde a lot or β-bydray before keron respectively. This react in the mind a distribution for the word "aidol" is derived from the combination of words aidebyds and a lohou the two functions, groups present in the product aid + of = aidol). For example,

In this reaction, the product is for und in such a way that the could age. If are motorule becomes attached to the carbonyl carbon of the second

The product of aldoi condensation on heating with dirate acids undergo dehydration to form α. β-unsaturated aldehydes or ketones.





It may be noted that if carbon carbon double bond in the product of dehydration is conjugated with oromatic ring is ich as benzene ring, the initially former aidet undergoes dehydration obtainmentally and the product of the reaction is always of fluoristic aromatic aldehyde or ketone.

Though ketones give ketolal compounds containing a keto and alcohol groups , the general name aidol condensation still applies to the reactions of ketones due to their similarity with aidebydes.

If the allightedy or helant does not contain on the hydrogen, it will not undergo in dolar advasation. For example formal delayed H^+HC_0 because delayed $C_0H_0\cap H^+$, because home $C_0H_0\cap H^-$, and $C_0H_0\cap H^-$ and $C_0H_0\cap H^-$ and $C_0H_0\cap H^-$ are do not undergo a state condensation.

- Wood confirm:

The \hat{u} -hydrogen atoms of aldehydes and keames are algebra and an instance due to strong electron withdrawing addictive. I effect of the carbonyl group. This anality of orbigal-pages is the interestinate south restrong of the αu_{q} against base. Due to electron withdrawing inductive effect. I effect of the carbonyl group, it withdraws electrons from the educant carbon-carbon bond. Thus makes x-carbon electron deficient and it in turn withdraws electron from C_{ϕ} . H bond. As a result, the electron density in C_{ϕ} . H bond, decreases and α -hydrogens, are weakly held and therefore, can easily be abstracted by strong base as

The conjugate base is called endote among the from dot bie bond and state from a rabilitie.

Step I in the first step, the case OH transvers proton one of the whydrogen atoms to form an enclude on from the adelyce or ket he way according to The encounter in gets stabilized by resonance.

$$H = CH, \quad CH_{a} = CH_{b} =$$

😒 op 🗓. The enniste an being a utimig nucleophile, attacks the carbonyl group of the second molecule of acetaidenyde as

Sup III The amon formed in step II abstracts a proton from water to form a dol.

Thus, the aldehydes or betones which do not have v-hydrogen cannot undergo aidol condensation.

Cross aidol condensation

The side condensation reaction is not confined to the condensation of two molecules of the same side lyde or ketone known as sed condensation. It can also take place between two different molecules of aidehydes or ketones or between one aidehyde and the ketone. The condensation of two different carbonyl compounds in the presence of a base is called cross aidol condensation of two different carbonyl compounds in the presence of a base is called cross aidol condensation of maked compounds on However, the mapour is used in these reaction must be selected carefully otherwise a maxture of severol products will be formed. For example cross aidol condensation of ethanal and propanal would give four products because either of these compounds can form end ate ion. Attack by the endate of ethanal or propanal gives a product different from the one formed by the attack of the endate of propanal on ethanal in addition, self-condensation of ethanal and propanal also occurs. These products are given below.

However cross aiddl condensation is aseful when one of the carbonyl compounds does not contain they dropen and therefore on not undergo self-condensation. For example, methanial formately defined benzoidely de have been successfully used with other aldehydes and knowns containing to hydrogen.

It may be noted that a cross aldo) condensation can be effective fut a planned so that only one of the reactant can form an entrate on and the other compound a more the y react with entrate on. The other side reaction self-condensation can be avoided by planning the compound with di-hydrogen to base and then slowly adding the reactant with di-hydrogen to the matrice I meet these conditions the concentration of the reactant with di-hydrogen will always be ow and must of a will be present as an end at each of Therefore, the door reaction that will take place will be between this enclate ion and that component which has no d-hydrogen

The reaction of condensation between an aromatic aldehyde for ketone, and on a sphatic aldehyde or ketone in the presence of direct asked to form 0, \$\beta\$ uncertainty compound is called theses. Schmidt reaction or simply Claisen condensation.

Beazeldehyde Na 0-hydrogen

Even alighetic esters containing a-hydrogen atoms undergo Claisen-Schmidt condensation on treatment with an aromatic aidebyde in the presence of base.

Summary of cross aldel condensation.

Planning Aldol Condensation Reaction

Aldo condensation reaction produces β -hyorexy. Tehydes or ketones, aidols; or α , β -unsati-rated aldehydes and ketones derivdrated products. From the product rectard, the starting materials can be predicted. For this in case of β -hydroxy aidehydes or ketones, β and the α , β bond and it case of denydrated product, the α , β bond is the double bond. For example,

For these, change C—OH bond of β -carbon to C=O and put back one H atom on the u-carbon stom.

Similarly

For these replace double bond to carbon with double bond to O and put back two H atoms on the &-carbon ston.

Learning Plas

Intramolecular sidul condensation. Eyekaation via aldul condensation

If a compound contains two addedy leaketone groups or one aldelively and one ketone group, then the enclate ion of one corbonyl group can add to the carbonyl group of the other. This reserves a called intramolecular addol condensation and provides a convenient method to prepare five or six mentioned mage. This reaction is also called addol cyclication. For example.

PERIAM CONDENSATION

It is an a.dol type condensation in which aromatic aidehydes react with an aliphaut carboxylic acid anbydride to give an α β-masot are sed as a. The catalyst commonly used as the sodium or potasor in succ of the carboxylic acid. For example,

12. Cannizzaro's reaction. Adeltydes which do not conto a only is hydrogen atom such as formalde tyde: HCHC and benzaidehyde (gH_bOHc) undergo self oxidation and reduction reaction on treatment with concentrated alkal. In this reaction, the molecule is oxideed to and while instance a reduced to also not Thus, a mixture of an about and a salt of carboxylic acid is formed.

■ Pares (内内体部): Mechanism of Canalizzards real con

Chambazoro's reaction is an example of hydride H) ransfer as anows below

Step I. The OH: on attacks the carbonyl carbon to forth hydroxy is kex. in it is a nucleophilic attack like other nucleophiles.

Step II The amon I acts as a hydride an donor to the second molecule of aldehyde. The presence of negative charge on I below in the loss of hydride ion. In the final step of the reaction, the and and the alkiands ion exchange proton to acquire stability.

Cross Currezzaro reaction. Like cross aldoi condensation, cross Currezzari reaction can also take place between two different indensation with const have cohydrogen atoms.

Introduced or Considered in We have so far considered the inter molecular Cananzzars reaction in which the reaction takes place between two molecules of the same or different adequates. The intra molecular Cananzzaro reaction may also take place in which the same molecule undergoes exidation as we as remaction. For example, glyona (CHO—CHO does not have e-nydrogen atom but contains two aldehyle groups in the same molecule, it can undergo intra molecular Cananzzaro reaction in the presence of strong alkali to form glycolic acid

19. Reaction with aluminium ethoxide. To chemics reaction. This is a modified form of Commission reaction. All aldehydes with or without to hydrogen can be made to undergo Cannizzaro reaction on treatment with abundance ethoxide. However, under these conditions, the applied and the next produced combine together to form ester. For example

This reaction is called Tischenko reaction

14. Halogenation. Aldeliydes and ketones has ag orbydrogen undergo in agenation under suitable conditions in which the bydrogens are successively replaced by halogen aroms. For example, when CL, is bubbled through acetaldehyde, choral is obtained.

Tredisorusthaual.

Similarly, when Cip is bubbled through warm aces are a dasta self-chioro propanes is obtained.

15. Action with Schiffs reagent. The Schiffs reagen, a pink coloured aqueous solution of resembne hydrochioride which has been decolourised by passing a diplan white When additydes are treated with broth three solution of Schiffs reagent, as pink colour is restored. This reaction is known as Schiffs test and is used as a test for aldehydes because ketones do not give thin test.

- 16. Polymerisation reactions. Adebvdes and ketones readily undergo polymerisation giving a variety of products.
- $(a) \ Polymers action \ of methanal \ or \ formal dehyde. For mode by defined and ergoes \ with the restriction of the formal dehyde in the restriction of the formal dehyde in the restriction of the formal dehyde. For mode by the restriction of the formal dehyde in the restriction of the formal dehyde. For mode by the restriction of the formal dehyde in the restriction of the formal dehyde. For mode by the restriction of the formal dehyde in the restriction of the formal dehyde. For mode by the restriction of the formal dehyde in the restriction of the formal dehyde in the restriction of the formal dehyde. For mode and the restriction of the formal dehyde in the restriction of the restr$
 - When formaldehyde is allowed to stand as room temperature, it allowly undergoes polymerisation and forms a white solid called trioxane or metaformaldehyde.

When an aqueous solution, 40% of formaldehyde (formalia is evaporated to dryness on a water both, it forms a white solid called paraformaldehyde.

On heating, paraformaldehyde regenerates formaldehyde

Formadehyde condenses with phenol in the presence of a base such as NaOH and forms cross-taked polymer caded bakelite. It is a synthetic phastic discussed in 1 mt 15.

(b) Polymerisation of acetaldehyde. Some important polymers of acetaldehyde inc.

When ocetaldehyde is treated with a few drops of conc. H_0SO_+ at room temperature. 298 K, rapid exothermic reaction occurs with the formation of a trimer called **parallehyde**.

CH₃

Para, whyde is a sweet sme ling liquid (0.p. 401 K) and is used in medicines as hypnotic-

On coming acetaidehyde with a few trops of cone H₀SO₁ at 0°C or dry h₀1 gas at 0°C, four molecules combine to form a cyclic tetramer known as metaldehyde.

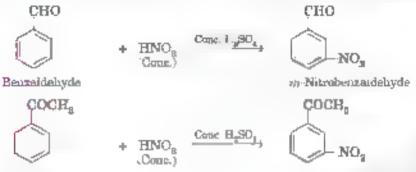
It is a whote soud bip. 5.10 K and regenerates acetaidehyde when distributional HiSO, (c) Polymerisation of acetone. Some important condensation products of acetone are When treated with try HC gas it gives austin and and a horon.

$$\begin{array}{c} CH_3 \\ CH_3 \\ CH_4 \\ CH_4 \\ CH_5 \\ CH_6 \end{array} \xrightarrow{C} \begin{array}{c} CH_4 \\ CH_5 \\ CH_5 \\ CH_6 \\ CH_6 \end{array} \xrightarrow{C} \begin{array}{c} CH_4 \\ CH_5 \\ CH_6 \\ CH_6 \\ CH_6 \\ CH_6 \\ CH_6 \end{array} \xrightarrow{C} \begin{array}{c} CH_3 \\ CH_3 \\ CH_6 \\$$

When treated with H₂SO₄, three morecules ger condensed to give mentylene

17. Substitution reactions of benzene nucleus in aldehydes and ketones. Aldehydir and ketonic groups are meto directing groups and therefore, substitution reactions form at meta positions. For example, Halogenation. It is carried by halogen in the presence of ferrir salt.

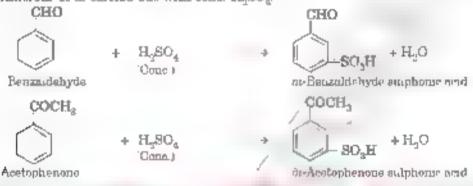
Nutration is carried by natrating maxture of cond HNO₃ and cond H₀St ...



Acetopheucoe

de Nitroscetophenous





COLVER SERVICED

Example 8-

How will you bring about the forciously removes one in not more than two steps?

ta, Propanone to propene

(D.S.B. 2017)

th, Propanal to butanone

e Benzuidehyde to benzophenone

id Benzaidehyde to Siphenyipropan Lol

re Benzaldehyde to a hydroxypheny, acerr acro

of Ethanol to 3-hydroxybutana.

Solution

of Proponess in propose

$$CH_{3}COCH_{3} \longrightarrow CH_{3}CHCH_{3} \longrightarrow CH_{3}CHCH_{2} \longrightarrow CH_{3}CHCH_{2}$$

Proponess

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CHCH_{3} \longrightarrow CH_{3}CHCH_{2}$$

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CHCH_{3}$$

Proposess

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_{3}CHCH_{3} \longrightarrow CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_{3}CH_{3}CH_{3} \longrightarrow CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$CH_{3}CH_$$

Benzaidahyde

Benzopbenone

d) Bonzaidehyde ω 3-phenyipropau-1-ol

C_aH_sCHO Bonzoldobydo HIAN A CALISCHEN

 $H \xrightarrow{H_{2}()} C_{g}H_{g}CHCOOH$ OH

o-Hydrogylogikovia

ALDEHYDES KETONES AND CARBOXYLIG ACIDS

f Ethanol to 3-hydroxybatanci.

 $\begin{array}{cccc} \mathrm{CH_{3}CH_{2}OH} & ' \rightarrow & \mathrm{CH_{3}CHO} & \overset{\mathrm{OH}^{+}}{\mathrm{Addu}} \rightarrow & \mathrm{N_{3}CH} \subset & \mathrm{MO} \\ \mathrm{Sthane)} & & \mathrm{candeconstans} & \mathrm{SHydninybulaneal} \end{array}$

Example 0...

Convert the following

- (a) Ethunas to propagane. (A.I.S.B. 2018)
- (c) Ethanul to 2-hydroxy-8-butenous acid.
- (e) Formaldehyde to acelaidehyde.

the Ethana, to lactic acid.

- (d) Acetatüehyde to formaldehyde
- (f) Acetaldehyde to crotonic acid,

Solution

to Ethensi to propanene

(b) Ethanal to rectac acid

to Elbanal to 2-bydroxy-3-butennic and

d. Acetaidehyde to formaldehyde

(e) Furnial debyde to acetaidebyde

HCHO
$$H_2/N_1$$
 CH₃OH F_{ij} CH₃C CH₃C CH₃C CH₃C Methyl alcohol Methyl acdide

No. electron

(f) Acetaldehyde to crotonic acid

Example 10. —

An organic compound A with molecular formula $_8H_8C$ forms an orange red precipitate with 2.4-DNP rangent and gives value, precipitate on heating with todine in the presence of sodium hydrocade. It mather reduces Towen's reagent or Feb. ing solution nor does 1 decolorises bramine water or Baeyer's reagent. On the indication with chronic and it gives a carboxylic and B having molecular form the $C_2H_8O_3$ identify the compound A and B and explain the reactions involved.

[N.C. E.K. II] BSE Sample Paper 2007

Solution :

- (c) The compound A forms 2, 4-DNP derivative so, it is an aldehyde or ketons
- a The compound does not reduce Toller's reagent or Fehling solution at a mass by a ketone.
- (tii) The compound gives indoform test so it should be a methyl ketone
- w. The molecular formula of A. $^{1}_{3}H_{3}O$ indicates high degree of unsaturation, yet it does not devolutise Br., water or Baeyer's reagent, this shows the presence of unsaturation due to the aromatic rung.
- . The drastic exidation with chromic and, gives carboxylic and B with molecular formula $C_rH_0O_0$ and it should be benzon and. Therefore the compound A should be monocularisticted aromatic motify, ketone. The molecular formula of A, indicates that it should be methyl phenyl betone.

The reactions are

□ Example 11.

An unknown aidehyde 4 on reacting with alkan gives a β -hydroxy-aidehyde which toses water to form an unsaturated aidehyde, 2 hatenas. Another aidehyde E undergoes disproportionalism reaction in the presence of conclusive form products ϵ and D —is an any alcohol with the formula $-_2H_{\phi}O$

- (i) Identify A and B
- (ii) Write the sequence of reactions involved
- Name the product when B reacts with rinc amalgam and hydrochionic acid. CBSE Sample Paper 2007.
 Solution:
- The aidehyde compound A on rearting with aikali gives a \$\beta\$-hydroxy aidehyde which loses water to form unsaturated aidehyde but-2-east. This is abled mademateria reaction.
 - The aidehyde compound B undergoes disproportions ton reaction with cone alkan. This is Pannizzaro's reaction
- The product C' is an anyl elcohol with formula C_2H_3O It must be $C_8H_3CH_2OH$ and is formed by condensation of benzaldehyde. Thus,

Example 12 .

A compound $X^*(C_gH_qO)$ on oxidation gives $Y^*(C_gH_qG_g)^*X$ undergoes hatoform reaction. On treatment with HCN^*X forms a product Z which on hydrotysis gives 2-hydroxy p-operate acid

9. Write down structures of X and Y

(n) Name the product when X reacts with dil NaOH

hit. Write down the equations for the reactions involved

**CPSE Sample Paper 2007 Assam S. B. 2017

Solution

Compound X $(\cdot \cdot_n H_q O)$ is exclused to $Y = _n H_q C_n$. Since it undergoes be offering reaction, it must be acctaldehyde $Y = CH_q C \otimes H$.

On arestment with HCN X gives eyembydrut which on hydroxyele gives 2-nydrutypropanote said.

Toluege

6 When 'X' reacts with dil No. H. it undergoes and a condensation reaction forming aldo) which on heating gives but-2-enal.

Other equations are given above

Example 18 —

Solution :

O
$$C_6H_5CHO + CH_5COCH_3$$
 $C_8H_5CH = CHCCH_3$ C_8H_5 C_8H_5

$$_{\rm cr}$$
 $_{\rm H_2CO}$ $_{\rm CHO}$ + HCHO $_{\rm EUR}$ H₂CO $_{\rm CO}$ $_{\rm TH_2OH}$, HCOUK

$$c = CH_{3} - CH_{4} - CHO + H - CHCHO \xrightarrow{OH} + CH_{5} = CH_{3} = C + CH_{5} = CH_{5}$$

.000) HCHO + HCHO
$$\xrightarrow{\text{Com_ROM}} \rightarrow \text{CH}_{2}\text{CHO} + \text{HCOC-K}^{\bullet}$$
.000) GE₄COC1 + H₂ $\xrightarrow{\text{Sd}_{1}\text{BaSO}_{2}} \rightarrow \text{CH}_{2}\text{CHO} + \text{HCL}$

Example 14. ——

Identify A, B, C, and D in the following remations

(a)
$$CH_{\delta}CH = C(CH_{\delta'2})$$
 $\xrightarrow{f(G) Z_{B_1}H_{\delta}O} A + B$

Giv
$$C_0H_0COOH + SOCI_2 \rightarrow A$$
 $\stackrel{P_{G}, BaSO_0/S}{B_2} \rightarrow B$

$$\mathcal{E}(t)$$
 CH_SCOOH $\xrightarrow{NH_S}$ $\Lambda \xrightarrow{P_2O_S}$ \mathcal{B}

$${}^{\circ}_{\mathcal{C}} \subset \mathsf{Cl} \xrightarrow{\mathsf{Pd} \cdot \mathsf{BuSO}_4} A$$

(vii)
$$CH_gCOCI$$
 $\xrightarrow{\mathrm{Pd/BaSO_4/S}}$ $A \xrightarrow{\mathrm{K_0Cr_0O_7/H^+}} B$

Meghalaya S.B. 2018)

Meghalaya S.B. 2013)

Assam S.B. 2018, H.P.S.B. 2016)

Assam S B 2015)

Assum S.B. 2015, CBSE Sample Paper 2017 18)

Assum S.B. 2017, 2018)

Meghalaya S.B. 2018)

Solution

Example 15. .

is An organic compound. A has characteristic whole On treatment with NaOH – forms two compounds iB and iC. Compound B has more cular formula $i^{C}H_{\delta}O$ which on and at on gives back A. The compound iC is a sad aim salt of an and When iC is two hid much sada – we do not an aromatic hydrocurbon. Do Deduce the aromatures of iA, iB iC, and iD, iV is one sequence of reactions – more iC.

To Compute each synchesis by filling the missing starting materials, reagents or products. (X. Y and Z.

$$G_{\delta} = C_{\delta}H_{\delta}CHO + CH_{\delta}CH_{\delta}CHO \xrightarrow{\text{NeOO}} X$$

to How was you bring about the farming conversions in not more than two steps?

4. Toluene to benzaldehyde

tis, Ethylcyanide to 1-phenyi propanane.

CBSE Sample Paper 2011,

Solution :

a. The compound A is Cart_CHO benzaldebyde having characteristic odour. The reactions are

$$C_0H^*CH^*CH^* \rightarrow C_0H_0$$
, $H_0CH^* \rightarrow C_0H_0CCON_0$
 $C_0H_0CH_0CH^* \rightarrow C_0H_0CHC$
 $C_0H_0COON_0$
 $C_0H_0COON_0$

 $A \quad C_{q}H_{q}CHO; \ B = C_{q}H_{q}CH_{q}OH; \ C = C_{q}H_{q}COONe, \ D \quad C_{q}H_{g}$

(b) (f)
$$C_4H_5CHO + OH_4CH_9CHO \xrightarrow{NaOH} C_8H_5 OH CH—CHO OH CH_4$$

Example 10. .

(a) How do you convert the following?

- (i) Ethanal to propanens
- for Taluene to benzoue acid

OR

16 A: B and C are three non-evene functional somers of a corbonyl compound with melecular formula C_qH_qO leavers A and C give positive Toliens less whereas isomer B does not give Taliens lest but gives positive codeform test Isomers A and B on reduction with Zn Hg vonc HCl give the same product D.

(i) Write the structures of (A, (B), (C) and (D)

Out of A. B. and C. comers, which one is wast routine town its audition of HCN?

A 1 S.B. 2018

Solution :

COOH

CH₃CHO

H₂O > CH₃ COH

Ethichic Brid

COOH

th Curr of A. B and C : A and give northwe Tollen's cest and therefore, these are aldeligides. B does not give Tollen's test and therefore it is ketone, with "C "CH, group accessed to give positive addition test. Thus the three isomers are.

 $C = (^{\circ}H_{+}CHC)HC$

CH.

n PHICHICH, CHO

B ጉዜ, ካርንዚረዝ,

D CHICK CHICH,

W. CH, COCH, CH, B) is least reactive

A)

Example 17. •

in An argume compound A has indeemar formula $C_sH_{t0}O$. It does not reduce Towers imagest but forms an orange preripitate with 2 4-DNP reagent. It does not give verous precipate on treatment with Natiff and L under vigorous conditions on exclution a gives ethanole and and a carboxytic and B_t Sodium salt of B_t gives a hydrocarbon C_t in Korbe's electrolytic reduction librarily A_t . B_t and C_t and write the reactions involved. On Predict the products formed in the following cases

- (i. (A) reacts with PhMgBr and is then hydrolysed-
- . A reacts with hydrazine and suhen healed with KOH and ethylene giveo.

(CBSE Sample Paper 201.

Solution

a The compound A does not reduce Tollen's reagent but forms an arange precipitate with 1. 4 DNP reagent so it must be

ketone Since it does not give caloform test, it is not a methy betone Therefore A is CHCHCCCCHCH, C.H., C.

12. Arrange the following in order of increasing boiling points.

(i) Propagous (ii) Propagal (iii) Propagal (iii) Propage (ii) Dimethyl ether

- Ano. (a) + (a) + (a) + .a) + .aa
- 19. Which of the following compounds would and right and condensation, which the Cannizzaro a reaction and which neither." Write the atructures of the expected productor if aidol condensation and Caminizaro's reaction

 CH_3CH_3

- o Benzaidehyde
- Denzuphennne
- c Cycloberanone
- d' Methane

- e 2-Methyl pentanni
- f Bucan 1-0)
- g Phenyl acetaldehyde A 1-Phenyl propanone

- 2 2 Dimethyl butnerd
- And Aide condensation $d_{-i}(f) \not\equiv \text{homizzaro's contion to } h$ neither $b \in \mathcal{S}$
- 14. Write the names and structures of the products formed by the following reactions
 - (a) Addition of HCN to sections
 - (iii) Reaction of semioarhands with formaldsbyde
 - Addition of Geignard reagent to Jutanone.
 - (10) Reaction of acetophenone with hydraxine in strong base
 - (v) Reaction of PCI, and proponous.
- 15. What is the order of reactivity of the following towards RCN?
 - (a) C,H,CHO
 - (a) 0,H,000,H,
- in CH_CHO (in HCHO
 - Arss. HCHO > CH_CHO > C_H_CHO > C_H_COC_H_
- 16. Predict the product of reaction of
 - (i sectone with smiling

- ,e) RCHO with hydramae in the presence of KOH
- .ut formaldehyde with ammonia
- (av) butanene with LiAlH,
- (v) aldehyde with Toilen a reagent
- (e) sectors with KMnO₄.
- Ans. (c) $(CH_{a/a}C NNHC_aH_a)$
- (a) RCH,
- (or (CH_{a'a}N_a Ucotropuse

- wo CH_CH_CHCHCH_
- (b) Carburyhe acid
- (tal) No reaction.

ÒН

- 17. What Grignard reagent would use to make following conversions?
 - (i) Acetopheomie to 2-phenyl-8-initenol
 - Cycloberanone to 1-propyl cycloberanol
 - .c.) Formaldebyde to benzyl alcohol.
 - Ans. (i) C.H.MgBr (ii) CH.OH.OH.MgBr (iii) C.H.MgBr



18, What are A and B in the following reactions?

(at)
$$CHO + CH_3COCH_3$$
 $OH - CH = CHC - CH_3$ $OH - CH = CH - C$

19. Identify the unknown organic compounds A to E' at the following series of chemics' reactions.

USES OF ALDEPYDES AND KETONES

Aldehydes and ketones are used in chemical industry as solvents, starting materials and reagents for the synthesis of other products. Some important uses of other products. Some important uses of other products.

(a) Uses of formaldehyde , methanal,

Formaidehyde is freely soluble in water 1.8.4 1% 50. 1300 ii; water is sold in market under the name formalin. Formaidehyde in the form of formalin (40% formaidehyde, 8% methanol and 52% water 45 used for preserving biological specimens

- 1 It is also used in the manufacture of synthetic polymers like bakelite and synthetic dye stuffs also indigo.
- au, Formaldehyde is also used as an disinfectanta.
- at It is used in leather undustry for lanning hides and as a reducing agent in silvering of mirrors and decolouring vat dyes.

(b) Uses of acetaldehyde (ethanal).

- Aceta Tehyde is used in the commercial preparation of a number of organic compounds such as acetic acid.
 ethyl acetate, n-butyl alcohol, etc.
- ur Paraldehyde is used in medicines as a hypnotic
- On Acetaldehyde in also used in silvering of infriora.

(c) Uses of benzaldebyde.

It is used as an important flavouring agent to perfume industry

- It is also used as a starting materia, for the synthesis of many offier organic compounds such as communicated, benzoyl chiloride, etc.
- sa. It is used in the manufacture of dyes ake malacinte green.

(d) Uses of acetone (propanone)

It is very important solvent and is extensively used as a solvent in industries and inhomitories.

- (ii) It is used in the preparation of chloroform, discetone alcohol.
 - It is used in the manufacture of thermosoftening plastic Periodex).
- ic) It is used as one of the constituents of liquid nail polish.

Many aidehydes and ketones such as butylaidehyde, vanshin acetophenone, camphor etc are known for their odours and flavours.

DISTINCTION BETWEEN ALDEHYDES AND KETCHES

Aldehydes and ketones can be distinguished by the following tests

	Test	Aldehydes	Ketones
1	With Tollen's reagent.	Form silver murror	No ethver mirror
2	With February amortical	Sive red presignate	No precipitate
3	With Schuffe reagent	Save public colour	No colum
4	Reduction with LaArH _e	Promary autobals are furthed	Secondary alcohols are formed
5	Arthur with electric to the presence of HCL	Pirm arethic easily	Do not form patals enally

DISTINCTION BETWEEN SOME PAIRS (CHEMICAL TESTS

1. Formaldehyde and acetaldehyde.

Areta, lehyde gives yellow ppt of iodoform with an alkn he are tion of iodoe

Acetaidehyda Yeliow ppt

Formaldehyde does not give this test.

2. Acetaldobyde and acetone

i) Acetaldehyde gives alver marror with Tollen's reagent

$$CH_3CH$$
) + 2,Ag(NH₃₋₃) CH \rightarrow CH_3COONH_4 + 2Ag + H₃C + 3NH₃
Acetaldehyde Tollen's reagent / Short

Acetone does not give this test

Bezzuldebyde and acetaldebyde.

Acetaidebyde gives yellow ppt with an alkaline solution of lodine while benzaldebyde does not give ppt

Benzaldehyde does not give ppt.

4. Benzaldehyde and acetophenone

Benzaldehyde forms silver mirror with ammuniacai silver mirror solution (Tollen's reagent). Aretophenone does not react.

$$C_0H_0$$
CHO + 2 $Ag(NH_0)OH$ \Rightarrow C_0H_0 COONH₃ + $2Ag$ + $3NH_0$ + H_0O
Table a respent $=$ Silver matrix

Acetophenone forms yellow pp. of iodoform with alkaline solution of iodine. Benzaldehyde does not react

$$C_0H_3$$
 COCH₃ + 4NaOH + 3L \rightarrow C_0H_3 COONa + CHl₂ + 3H₂O + 3NaI Yellow ppt

6. Pentan-8-one and pentan-2-one

Fentan-2-one forms verious ppt with alkaline solution of rodine. Pentan-8-one does not give yellow ppt.

Pentan 2-one gre will a ppt with sodium assurphite while pentan-3-one loss not give.

Acetophenone and benzophenone

Acetophenone gives yellow ppt with alkaline solution of indine. Beazophenone does not give this test



Conceptual Questions ____1 ___

Q. 1. Why do aldehydes and ketones have high dipole moments ?

Ans. The carbonyl group to eidebydes and ketones contains a double coud between carbon and oxygen atoms. Since oxygen to more electronegative than carbon, the carbonyl group is a polarised group.



Corgen gats a considerable negative charge while carbon gats a considerable positive charge. Therefore, aldehydes and betones have high dipole manients.

Q. 2. How does > c = c < deffer from <math>> c = 0 group to chemical reactions?

Ans. The ethylenic double could differe from earbonyl group in the following ways:

- ϵ . Hatogens, halogen wade and H_2SO_2 undergo addition reactions with athylenic double bond but not with carbonyl group

Q. 8. Sodium bisulphite is used for the purification of aldehydes and ketones. Explain-

Ans. Aidebyties and ketones react with sodium bisulplate to form admining compounds

The addit on products are created in admid. These can be decomposed by intered acids or aqueous alkabet to give back the original aldehyde or actions. Therefore this reaction can be used for the purification of aide-bytes and ketimes.

Q. 4. In the preparation of acetaldehyde from ethyl airchol, it is distilled out as soon as it is formed. Explain.

Ans. Aidehyde is easily exidicable to greate and Therefore to prevent its exidation, it is distilled out as soon as it is formed.

Q. 5. Oxadation of toluene with CrO₈ to benza 'tehyda is carried out in the presence of acetic anhydride.

Ans. During the oxidation of totalene wild: rO₂, as soon as tenzandehyde is formed, it reacts with acetic analydede so form beinguidene discretate. This checks the further oxidation of benzandehyde to beingoic and

hings Beszyhdene discelate

Q. S. Aliphotic aldehydes do not show position isomers. Why?

Ans. In case of abplicatio aidebydes, the --CHO group is always present at the end. Therefore, they do not above position terminant.

Q.8. Distinguish between

$$C_aH_aCH = CH + COCH_a$$
 and $C_aH_aCH = CH$ CO CH_aCH_a

(A.I. S.B. 2010)

Anse Heat both the compounds with NaOH and I, $C_0H_3CH = CHCOCH_3$ gives yellow ppt of codoform $C_0H_3CH = CHCOCH_3CH_3$ does not give yellow ppt. of sodoform

(H.P. S.R. 2010)

Q.0. What is formalin ?

Ans, Formslin is a 40% aqueous solution of formsidehyde

- Q.10. Give the different products obtained when but , you undergoes
 - Aydeoboration exidation reaction
 - ill Hydration in the presence of Hg2+ and H1

- Q.1. An organic compound with molecular formula C.B.O forms 2, 4-DNP derivative reduces Tollen's reagent and undergoes Unnuizzare reaction. On vigorous exidation it gives 1, 4-benzens dicarboxylic and Identify the compound.

 (Meghalaya S.B. 2015)
- Ans. The given compound forms 2-4-DNP derivative. Therefore, the sit addresses between the reduces Token's reagent that he addressed. The compound undergoes commissions reached so it does not contain a hydrogen. On vigorous ordered, it gives the benzenedicarboxytic soid, it means that it must be containing alkyl group at 4-position with respect to -QHO group on the benzene ring.

 CHO

The nuclecular formula suggests it should be CH₂CH₃

Q.12. Arrange the following in the increasing order of their reactivity in nucleophilic addition reactions.

CH_CHO, C_H_CHO, HCHO / LALS.B. 2016.

Ann. C.H.CHO < CH.CHO < RCHO

Q.18. Explain with the help obenical renotion:

Two molecules of beazaldehyde are treated with cone. NaOH.

(Meghalaya S.B. 2010)

Ans. C.H.CHO + C.H.CHO Oer. Maids + O.H.CH.OH + C.H.COONs

Benzatdehyde Benzy decisor Sodium benzoare

Q.14. Write the product in the following reaction:

 $CH_{\bullet}CH = CH - CN$

(A.LS.B. 2017)

Ans. CH_CH — CH_CN = 40 300At 0 — CH_CH — CH_CHO



CARBOXYLIC ACIDS

Carboxylie acids are the compounds containing the earliest functionic group

C OF

In their molecules. The carboxyl group is made up of carbony. C = 0 and hydraxy. OH groups and therefore, the name carboxyl is derived from carbo from carbonyl long any from hydraxyl group.

The carboxy or against may be a phone R— 4.00H or anomalor Δr =0.00 H. Hence fing then whether -0.00 H group is attached to apphabe alkyl chain or anyl group respectively. The general formula is



An phase corboxy is acid (where R = H or any alkyl group)

Aromatic carboxyur actr (where Ar is only anyl groupSome tugher members of aliphatic carboxylic acids C_{ij} , C_{ik} are known as fatty souds because some of these are obtained by the hydrolysis of fats. They occur in natural fats as esters of glycerol. Carboxylic souds serve as starting materials for many other important organic compounds such as anhydrides, esters, acid chlorides, annides, etc.

NOMENCLATURE OF CARBOXYLIC ACIDS

Aliphatic and aromatic carboxylic acids are classified as mono- d. in- or poly-carboxylic acids according as they contain one, two, three or many carboxylic acids in their molecules.

Monocarboxylie acids

The **common** is trivial names of carboxylic ands are based on their sources of origin. For example, forming and HPOOH is at named because it was first obtained from red ants. Latin forming means ants. Summarly, acetal and PH,COOH is so named because it was obtained from vinegur. Latin decrease meaning butter, the decrease meaning butter that the third half with the half of th

In common system, the position of the substituents is indicated by the Greek letters (α , β , γ , δ , etc. -

The carbon atom adjacent to the carboxyl carbon is assigned the letter a, the next carbon on chain as β and so one For example, $a \in C - C - C = C + a$ if

According to IUPAC system, the name of the acid is derived from the corresponding alkane by replacing the terminal ie' with '-die' and adding the word acid. The position of the substituents is indicated by the following rules

- I The longest chain containing the carboxylic group -OOCH is selected
- The carbon chain is numbered from the carbonylar ack group. The carbon of carbonyl group is always given number 1.
- 3 The position of the substituents is indicated by the number. For example.

HCOUH	CH, NOOE	сн,сн, снеоон	čн _а čн _а сновон
Methanque acid	Etheumejand	Вс 2-Вениовиланом всед	CH _s 2-Methylbushnor and
CH_s	7	CHO	o o
CH,CH, CCH,CH	Ген, ен, сн соон	сн, гн соон	CH, C-CH,COOH
COOH 2-Ethyl-2-methylbutanone acad	NH ₃	2-Methyl-2-axopropanoic scid	\$-0xobusanos end
C"H"GH"GOOH	C'H'CH'CH'COOH	J: ★COCH	
2-Phenylethenoce and	9-Phenylproponous and	${\bf 4} \cdot Cheoryelohexan \cdot 1 \cdot carboxybe \ acid$	
(н, н = снен = лестн	сн, доон	, сн.	о н_с_со н
Hexa-9, 4-dieune and	2-Phenylethanou and Phenylacetic acid)	:-Рынукрторию вод	Formyl methanuce acid or Oxoethanouc acid

The common and IUPAC names of some monocarboxylic ands are given below

Monocarboxylic acid	Соштоп пате	RP4C name
He in iH	Formur and	Mathemore and
сн,соон	Auetac ecid	Elasmor ema
CH,OH, NOOH	Propioner acid	Propunose acid
CH, CH, CH, COOH	a Buttone and	B) some arid
снусисоон	Isountyric seed (n-Methylpropionic acid)	6-Methylpropenou and
CH,		
си,си,си.си,соон	Valenc and	Pentanno sod
сн, сн. ,соон	n-Caproic seid	Hexanore send
ун² он сн°соон онс—соон	Glyoxylic and	Oxoethmon, and
CH,	Isovalenc acid	8-Methylbutanosc acid
CH COOH	te-Hydroxy propionir and or Lache and	2-Hydroxypropanoic ama
СН,—СНСООН	Aarylic acid	Prop-2-enore and
сн, сн=снесон	Protonue need	Bi -2-more and
C"H" GHCOOH	immenue seid	9. Phenylpran-2-enor and
с,н, тыон соон	Mandene and	3-Hydroxy Thenylethanne and

Some higher popular corbraylic seids CH, CH, DOOR Capitol edd. Decarrant and CH_(CH_)_COOH Laure and **Distlerations and** THE RESCRIPTION OF THE Mynatic seid Terradecapoic acid THACK ,COOK Palmutar and Hexadecanore and) PH, CH. _RCOOH Steame acid. Octoderance acid

The simplest aromatic acts is benzoic acid. The IUPAC names of the salistatuted acids are derived by prefixing the name of the substituent to the name of parent acid us benzoic acid and the position is indicated by an Arabic numeral with the carbon atom carrying the — COUH group being numbered as 1. For example

Dienglioxylie neids

These routan, two rarboxy is said groups, one at each end of a hydrocarbon chain. These are named as **alkanedicio unida.** Most directorylic acids have common names

Diearbusylle seid /	Сожнов ваше	TUPAC mame
ноос соон	Oxetic seid	Ethanedion and
CHT COOH	Melense seid	Propanedious anid
сн,соон сн,соон	Succime acid	Butanedicie acid
HORENTH, SOUTH	Gh dame acid	Ревидлениям подд
HOURT ATHER STORY	Adapte and	Hexanedinic acid
н од он-сн соон	6-Acety- succinae acid	941-Oxoethy) butane-1 4-dame and
cocH,		

The minutes aromatic dicarboxylic acids are

ROOS

JOOH COOH

Benzene . 2-dicarboxylic acid. Photenic erid)

Benzene z 8-dicarboxylic acid (Isoobthalic acid)

Benzene 7 4 dieseboxytic acid (Tersohthalic acid)

IUFAC 1993 Recognized at case for Capacitar is confuring acres than two Coche, who acres

According to latest ILFA. recommendations if an unbranched chain is direct bonded to more than two like functional groups, the argains compaind is named as a derivative of parent alkane which does not include the carbon atoms of the functional groups. These are named by the use of suffix such as accurboxylic acid for three - 10H groups). For example,

HOOC_CH CH CH_CH CH COOH

HOUR CH, C CH, COOH

Pentane 1 9 5-tmcarboxylic acid formerly 4-carboxyheptane 1, 7-diose acid Hydroxypropene-1 2 a-thearboxytic sera.

However if three COOH groups are not directly anked to be antiranched chain, the two ake groups are connidered to the parent chain and are named by using the suiffix dilibefore the name of the functional group. The third group forming the side chain is considered as a substituent group. For example,

HOOC-CH, CH, CH, CH-CH, COOH

Эн,Орын

(8-Carboxymethyl) haptane 1, 7-diou and

20. Write the IUPAC names of the following:

FOR THE CHOUGH THEOSON IN TROUBLE OF CARLOTTERS OF THE STATE OF THE ST

си,си,сосилсоон и си, соль,соон

as H. CH. CH. COUR

Ans. (# 9-Butenmo erial

(a) Pentanme neid

(iii) 3-Phanylpropagme neid er 8,3-Dimethylbutanine acid

 2 Dimethylpropanoic and v 3-Oxopentanoic and 224 B-Hydroxybutanose acid

21. Give the structures of the following

Phony: acetic and

Trimethyl neetic and a lee-valenc and

a + Medonar acid

(a) Adapte acul-

Ans. tr C_sH_sCH_sCOOH

in CH, i, C COOH (in) CH, i, CHCH, COOH

a HOOCCH, COOH

22. Write the Π PAC names of the following acids whose common names are given

Isobutyne acul

(as. n. Valeric and

ലി Sueemic ലേർ

(au) Phenyl acetu aud.

p) Majorae and

 Ans. 2 Methylpmpanor and 4 Pentanor and 6 Butanedior and v Propanedioto ecid

a Pheny ethannic and

23. Write the functional isomers of proponous and

Ans. Methyl ethanoate, CH,COOCH,...

- 24. Draw the structures of the following
 - (i) 8-Broine-4-phenyl pentaggic and
 - Ans. (c) CH₁—CH—CH—CH₂CCOH C₂H₁ Br

(a) Her-2-an-4-yrane and (a) $CH_1C = C$ —CH = CH COOH (ALSH 9005

METHODS OF PREPARATION OF CARBOXYLIC ACIDS

Some of the general methods for the preparation of carboxylic acids are described below

1 From exclaim n of primers also hole. Primary acohole are read, y exclused to carboxylic acids with exidising agents such as potase, impermanganate $\epsilon KMnO_s$ potasent in dictirontate $K_sCr_sO_s$ in the real sortion is kaline media and chromo an triexide ϵCr_sO_s in order media. The exidation with $K_sCr_sO_s$ or CrO_s in order media generally gives some amount of exters. Therefore, exidation with $KMnO_s$ in neutron or also me media in a preferred for the preparation of corboxylic acids.

The acid is first obtained as its potassium sait, which on treatment with mineral acids gives carboxylic acid.

2 From oxida i in of a debydes and between s. Aldenydes are easily undised to carboxylic ands even with tailo oxidising agents like Tallen's reagent



Ketones are madised with difficulty and usually a maxture of acids is obtained.

3 From hydrolysts of purities or cyanides and amides. The intriles are hydrolysed in dilute aqueous and or alkaline medium. The alky intriles are first hydrolysed to similes in the presence of and or alkali and then to acrils

The asky, cyanides accord for the purpose are prepared from corresponding alkyl habdes or alcohols as

It as y be noted that the and produced contains one is we exchon a oin than the original alkyl hande or named. Thus, the hydrotysis of nortles provides a useful method for the preparation of carboxylic acids containing one more curbon atom than the starting alkyl halide or alcohol.

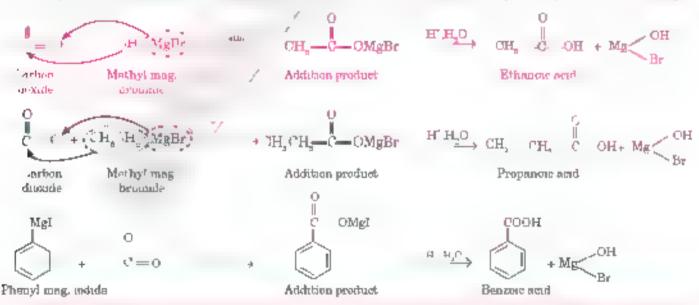
The arylinitries needed for the purpose are prepared either from the corresponding arylinalides or arylamines via diazonium salts as shown below

HOTE

L may be noted that mild rendshons are used to stop the reaction of anode stage. For example, amides are produced by shaking the natrices with cold conc. Hollor by dissolving the natrices in cold conc. HiSt, and then pouring the reaction mixture into water.

R
$$C = N + H_{\bullet}O$$
or cold cone $HCt \rightarrow R - C - NH_{\bullet}$
Allowe nightly

4 From Garginard reagents. Carboxylic ands, as be prepared by the action of Garginard reagents on carbon dioxide dry ice. The reaction is carried out in otherwice solution of smillible Garginard reagent and NO₃. It first forms sults of carboxylic and which in turn are decomposed with inners, ands to corresponding carboxylic ands. For example,



It may be noted that the end formed by this method contains one more carbon atom then the original Grignard reagent

5 From acyl halides and anhydrides. Acid chlorides on hydrolysis with water give carboxytic acids. These are readily hydrolysed with squeous base to form carboxylate tons which on acidification give corresponding carboxylic acids.

Arid anhydrides are also easily hydrolysed to give scids.

6 By hydrolysis of esters. Carboxylic acids can also be obtained by the acum vata of exters with mineral acids or alkanes. Acids: hydrolysis of esters gives directly carboxylic acids while acids by broadysis gives curboxylices, which on acids feature give corresponding carboxylic acids. For example,

7 Carboxylation of alkenes. Carboxylic acids are obtained on a large scale by hearing alkenes with CO and stema under pressure with phosphoric acids. 573-678 K. This reaction is called **Koch reaction**.

8 From trabalogen occive eves of hydrocarbons. Carboxylic acids can be prepared by the hydrocysis of 1-1 trabalogen derivatives of a kanes, arbandes, with aqueous KOH. For example.

9 Preparation of aromatic acids from alkyl benzones. The alkyl side chain of benzene ring can be easily exidesed to carboxylin group with an imor alkalane KWhO, chromin acid or conc. HNO.

Presence of electron withdrewing groups on the benzene ring increases the reactivity of the benzylor hydrogens. For example, positrotoluene is much more easily oxidised as compared to toluene.

$$\begin{array}{c} CH_{0} \\ & \downarrow \\ & \downarrow \\ NO_{0} \\$$

It may be noted that the complete side alkyl chain gets exidised $\omega = 0 \cup 0$ if group arrespective of the length of the chain.

If the ring contains two or more alkyl groups, each one is outlised to carbanyl group.

NOTE

It may be noted that only primary and secondary alky lade chama in the sensene ring —c, thuse containing benzylu hydrogens are axidised to cerboxylic souds. The services will nide chance, which do not contain benzyluc hydrogen, are not studied.

do bertayan $H_{
m c}$

It may be concluded that larger the number of H atomal greater is the ease of oxidation. Thus, the case of midshon of different alkyl side chains follows the order $1^{\circ} > 2^{\circ} > 3^{\circ}$

10 From methyl ketones or methyl carbinols. Methyl ketones or methyl carbinols on treatment with a solution of sodr on hypoinable (NaCl NaCl) or NaCCl ondergo haloform reaction to form corresponding haloform. CHI₃, CHBr₈ or CHCl₄ and sodium salt of carboxylic acids commining one carbon atom tess than the parent methyl ketone or methyl carb now. The sodi an east of harboxylic acid of hardification gives the corresponding acids.

11 Oxidation of alkenes. Alkenes can also be cleaved by oxidizing agents such as hot acidic $KMnO_q$ or $K_p V_q O_q$ solution. For example, substituted alkenes give only acids.

The terminal CH_0 group of a walkens is completely condized to D_0 and water while disubstituted carbon atom of double bond becomes the DC=D group of a ketone.

Mon marbi-xylic acids call also be prepared by heating an alkene with carbon monoxide and steam under pressure at 578 to the presence of H₂PO₄ as catolyst. For example, $CH_{2} = CH_{4} + CO + H_{2}O + \frac{H_{2}PO_{4}578 - 678K}{miler pressure} + CH_{2}CH_{2}COCH$ Ethene (steam) $CH_{3} = CH_{4} + CO + H_{2}O + \frac{H_{2}PO_{4}573 - 678K}{miler pressure} + CH_{3}CH_{4} + COOH$ Propene steam

3-Methylpropanoic scul

12. By passing carbon monoxide on heated sodium alkoxide. Farbon monoxide is passed over heated suitable sodium allumde under pressure to form sodium eart of the carboxylic and, which upon subsequent and dication gives the corresponding acid.

REMEMBER

An ama-RCOOH can be converted into its next higher homologue, RCH₂COOH, by a method known as Armida. Ensured synthesis. This conversion is also called **homologation of an acid**. It involves the following steps:

The reaction occurs as

The conversion of diazoketone to ketone upon heating with Ag, it is known as Wolff rearrangement

SOLVED EXAMPLES

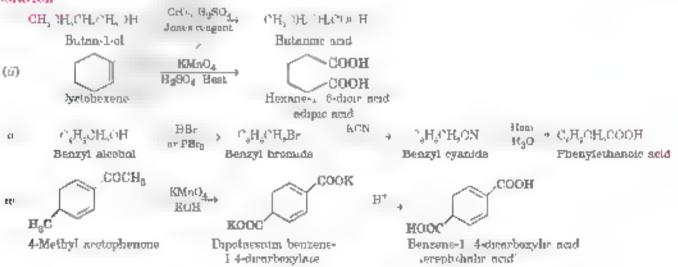
Example 16. _

How will you convert the following ? Give chemical equations :

- 4. Butan 1-ol to butanoic and
- fig. Cyclohexens to Hezane-I. 6-dimo acid.
- (nu Benzyl alcohol to phenyl ethanose acid
- (m., 4-Methyl acetophenone to benzene 1, 4-dicarboxyue acid
- (v) 3-Nitrobromobenzene to 3-nitrobenzoie acid
- tvi. Butanal to butanose acid

V.C.B.R T.

Solution



AUDEHYDES, KETONES AND CARBOXYLIC ACIDS

25. Write equations for the preparation of beazon and from the following compounds

- beneyl nleahol
- (it) loluene
- (a) benzamtrile
- er) ethyi benzene
- v) beass authlonde

26. How will you prepare

- a acetar acid from acetylene
- w butanoic seid from 1-propanol
- tis benzoic acid from aniona
- ethanoir and from earbon dioxide
- 27. Complete the following reactions indicating the major product formed

$$(O C_1H_1CN + H_1O \xrightarrow{B} AB \xrightarrow{K_2C_{L_2}O_mH} CH_3$$

$$(O C_1H_1CN + H_2O \xrightarrow{B} AB \xrightarrow{K_2C_{L_2}O_mH} CH_3$$

$$(O C_1H_1CN + H_2O \xrightarrow{B} AB \xrightarrow{K_2C_{L_2}O_mH} CH_3$$

- Ans. by Benzoic acid
- (cr) Terepitthebe said

124 Bengnie neid

- to) Propanole and
 - (v) Acetir arid
- 28. How would you carry out the following transformations?

$$0 \longrightarrow CH_2OH \longrightarrow CH_3CH_4OH$$

$$0 \longrightarrow CH_2OH_4OH$$

$$0 \longrightarrow CH_2OH_4OH$$

Аль.

PHYSICAL PROPERTIES OF CARBOXYLIC ACIDS

The important physical properties of carboxylic acids are given below

1 Physical state. The first three members of the carboxylic scide are colourless, iguids and have pungent smell. The next on members are only biguids with a faint unpleasant adour. Thereafter, they are committees waxy souds. Benzoic. acid and its hemologues are colourless solids.

2. Solubraty Among the abpender acids, the first four members are very so the in water and the soluble ty decreases gradually with the use in molecular mass. However, all are soluble in alcohol or either. Benzoic acid is aparingly soluble in cold water but as soluble in hot water, alcohol, either

The solubility of lower members of carboxylic acids is die to the *hydrogen bonding* in which the carboxylic ixygen forms bydrogen bonds with H atoms of water and bydroxylic H atoms. OH form bydrogen bonds with oxygen atom of water as shown alongside.

The soft braity of carboxylar and gradually decreases with the increase in size of the alkyl group or molecular mass. This is due to reduced botanty and hindrance provided by large bulky groups to the carboxylar group for taking part in hydrogen bonding. For example pentanon and and hexanon and are only slightly southe in water. But the higher members are practically insoluble in water.

Aromatic acids are almost insoluble in water Benzoic acid, for example, the simplest aromatic carboxytic acid is nearly med ible in cold water. However, it is sufficiently soluble in but water. Both alighbatic and aromatic carboxytic acids are so tible in less polar organic solvents such as benzene, ether and alcohol.

Hydrogen conding of RCOOH and H. →

8 Boiling points. The carbody is acids have higher boiling points and to the presence of intermolecular hydrogen bonding. As a result of hydrogen bonding, they exist as dimers. The hydrogen bonds are not broken completely even in the vapour phase. In fact, most carbodylic acids exist as dimers in the vapour phase and in aprotic solvenus. They have higher boiling points than the corresponding aidehydes, ketones and even alcohols of comparable molecular masses.

For example, the boiling point of ethanoic and is 391 K whereas that of propanol is 370 K, both have molecular mass 60

Compound	CH'COOH	си сили,ои	. H'GH'GHO	CH,COCH,	си,си,си,си,
Rodling point	Acetic acid age K	e-Propyl alcohol	Proponsidehyde Boo K	Acetone 899 K	e-Busace ana K

The ingher boding points of carboxylic acids compared of feetiles is the to the following reasons

- As compared to alcohols, the O—H lond is arbestle units is more strongly polarised due to the presence of adjacent electron willideawing carbonyl group. Therefore, carboxylic acids can form stronger hydrogen bonds.
- a. The mojecules of carboxylic acids are held together by two hydrogen bonds and therefore, form evelic dimers

Thus, the carboxylic acid molecules are held together by strong attractive forces and therefore, they have higher softing points. The existence of wells it meres of carboxy is acids as a apported by the fact that the observed molecular masses in solvents are quite higher almost double than their actual values. For example, the molecular mass of acetic acid is become as determined by measurement of colligative properties such as depression in freezing point is 120 meters of 60. This shows that acetic acid exists as dimer in beazene.

Among the monocorboxylochids the boiling points increase with increase in the molecular mass. As the size of the alkyl group increases the magnitude of the altractive forces, which are the van der Wasi's forces, increases and therefore boiling points increase. For example,

Acid	нсоон	снусоон	с н,соон	C,H,COOH	
Boiling point	378 K	391 K	±24 h	437 15	

4 Mel tog points. The melting points of carboxyle acids acrease areg darry with increase of molecular mass. It has been observed that for the first ten members, the melting points of carboxylic acids containing even number of carbon atoms, a righer than the next lower and higher member containing odd in imber of carbon atoms. For example,

Acid	CH,CH,COOH	CH CH CH,COGH	CH, CH CH, COCH
	3 carbons)	(4 carbona)	5 carbona)
Melting point	26.)ওৰ	137

The X-ray diffraction studies have shown that the soids with even number of carbon alone have carbonyl group and terminal methyl group of the opposite sides of the zig-zag carbon chan. As a result, they fit into the crystal lattice better and results in stronger intermolecular forces. In the other hand, the acids with odd number of carbon shows have carbonyl and terminal methyl groups on the same side of the zig-zag carbon chan. Therefore, these fit in the crystal lattice poorly and, hence, have weaker intermolecular forces. Thus because of stronger intermolecular forces, the me tang points of carbonylar acids with ever number of C atoms are higher than those of odd of interior of C atoms above and below it. This trend is, however, noticed only in members having up to ten carbon atoms, in higher members the melting points generally increase with increase in more darriness.

The meeting and boxing points of aromatic acids are usually higher than those of all phatic acids of comparable molecular masses. This is probably due to the fact that benzane has planar ring which can pack closely in the crystal lattice than zig-zag structure of alignatic acids.

CHEMICAL PROPERTIES OF CARBOXYLIC ACIDS

The main chemical characteristics of carboxylic acids may be discussed, inder the following heads:

- A. Reactions due to hydrogen atom of carboxyl group.
- B. Reactions due to OH part of carboxy, group
- C Reactions due to carboxyl group.
- D. Reactions due to alkyl group and benzene ring.
- A. Reactions due to hydrogen atom of the carboxy' group Unvolving cleavage of O-H bond
- 1. Acidic character. Carboxylic acids are do metly scided. They rouse in water to give Lydronium on as

However the north strength of carboxylic ands is much less than that of the numeral acids. The strength of the soid depends upon the extent of ionization, which in turn depends upon the stability of the anion formed. Carboxylic acids are acidic because the carboxylate ions formed are stable and hence carboxylic acids have greater lendency to concerto form stable carboxylic cause. This can be understood as follows:

The carboxylic acid molecule is resonance hybrid of the following two structures.

It is clear that in the resont inerryland structure H. the oxygen atom of the hydroxyl group carnes some positive charge. Consequently, the electron pair of the O—H is displaced towards oxygen atom. This displacement of electrons causes the release of a proton, and a carboxylate ion. RCOO is formed.

The corboxylate for this, formed is also a resonance hybrid of structures III and IV as shown below

$$R-C \xrightarrow{O_1}^{O_2} \longleftrightarrow R-C \xrightarrow{O_3}^{O_4} = R-C \xrightarrow{O}^{O}$$

This we observe that carboxy in and as we has its amon are resonance stabilised. However, if we compare these structures, we observe that resonance is less important for the acid than for the carboxylate ions.

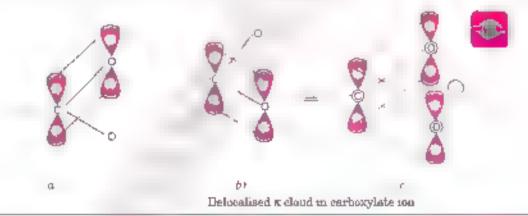
The contributing atructures of carboxylor acid are not equivalent and therefore, these may be of inferent stability. On the other hand, the commutating structures of carboxylate ion are equivalent and therefore, these must be of equivalent. These equivalent structures of carboxylate, on contribute to its greater stability as compared to that of carboxylic acid mosecule.

The contributing structures of carboxylate ion have only negative charge, whereas those for carboxylar and have positive and negative charge. Since energy must be supposed to separate opposite charges and therefore, structure II should contain more energy and therefore less stable than 1.

Therefore, the carboxylate ion is more resonance stabilized than the carboxylic and. Thus, the carboxylic ands readily give a proton to form stable carboxylate ion.

The resonance of carboxylate ion is also supported by the bond length values. In carboxylic and there is one carbon-oxygen double bond and one single bond. Therefore, we expect these bonds to have different bond lengths. In the other hand, in carboxylate ion, there is resonance between two equivalent structures and therefore, we expect the two carbon-oxygen bonds to be of equal bond lengths. This is expected to have bond length between double and single bonds. The above complision is supported by λ may and electron diffraction studies. For example, in formic and the bond lengths are $1.00 \, \mu \mathrm{m}$ engle bond, and 198 pm, double bond. In the other hand, in sodium formate, containing formate ion, two carbon-oxygen bond lengths are same, 127 pm, each which de between the values of C=0 and C=0 double engths. Carboxylic acids readily give proton, a form stable carboxylate ion.

The stability of carboxylo a ion can also be understood to some all delocalisation of the π -electron density. The carboxyl carbox involves applying the following one only bridged π -orbital. This π -orbital can overlap sidewise with either of the π -orbital of exygen atom forming π bond. Fig. α and $b \in T$ by resulting π -orbital cloud is spread over noth exygen atoms and carbon atom. This delocalisation gives stability to the carboxylide con.



Expressing strength of carboxylic acids. The carboxylic acids are acids. However, they are much weaker acids than the mineral acids. The strength of carboxylic acid can be expressed in terms of the hissociation constant $K_{\rm e}$ as:

$$K_{a} = \frac{\text{RCOOT} \text{ IH}_{a}\text{O}^{2}}{(\text{H}_{a}\text{O}) \text{ IRCOOH}}$$

$$K_{a} = \frac{\text{RCOOT} \text{ IH}_{a}\text{O}^{2}}{(\text{RCOOH})}$$

$$K_{a} = K_{a}\text{[H}_{b}\text{O]} = \frac{\text{RCOOT} \text{ IH}_{b}\text{O}^{2}}{(\text{RCOOH})}$$

The dissociation constant is generally called southly constant because it measures the relative strength of an acid. The stronger the ociel, the larger will be its K_value

The dissociation constant of an acid can also be expressed in terms of pK, which is defined as

$$\rho K = 40g K$$

Now a stronger acid to I have higher K_i value but smaller pK_i value while a weaker acid to I have smaller K_i value but higher pK_i value. In other words

larger the value of pK, weaker the acid is.

The K₁ and pK₂ values of some acids are given below

Artid	K,	pK,	Acid	K,	pK,
HCOOH	177×10°	578	$C_{s}H_{s}COOH$	33×10°	4.70
H ₃ % () H	77 a x0 ⁻⁴	4.76	pN 2H, NOOH	48 x 0"	n 44
FCH,COOH	200 € 10%	2.59	ar No. C _s H, COOH	d2 x x0 ⁻⁴	9.50
CICHLOUGH	236 x 10°	2.87	o-No. C _a H _a COOH	87€ × 13 ⁻⁶	2 .7
Bethlywardt	25×10^{16}	2.0	path, then H	4.2 = 3.7%	4.75
ICH,COOH	6" = 10"	3 .41	m-CH, C,H, COEH	6 4 × 10 ⁻⁶	4.7
CLOHOUGH	5530 x 10 ⁻⁶	1.26	of H LH WH	12.4 × 10.5	5.0.1
T, West H	29200 a 40°°	0.69	$\operatorname{neOH} \cap H_{\mathfrak{p}} \longrightarrow \operatorname{H}$	195 x I 1°	2.88
CH_CH_CH_CICOOH	130×10^{-5}	2.88	wi-DH C ₂ H ₄ COOH	8.3 m 10 ⁻⁵	4.08
H, Hach, Cook	8 H × ±0 ⁻⁶	4.05	park all the H	2 8 ≤ 10-4	4 58

In general, strong acids have pK_1 values < 1, the scale with pK_2 values between 1 and 5 are considered to be moderately strong acids, weak acids have pK_2 values > 15.

Effect of substituents on acidir strength of no da. The substituents have a marked effect on the architectrength of carboxy in saids. The nature of substituents of refer the stability of the corp. gate base comboxylate ion, and hence affects the acidity of the carboxylate acids. In giver a personal matter groups, EWG increase the stability of the carboxylate ion by decombining the negative charge and hence increase the acidity of the carboxylate acid. Conversely electron functing groups, EPG decrease the stronger and hence decrease the acidity of the carboxylate ion by intensifying the negative charge and hence decrease the acidity of the carboxylate ion by intensifying the negative charge and hence decrease the acidity of the carboxylate acid. This is discussed below.

(a) Electron doubting (or releasing) substituents. Alkyl is an electron releasing group. If the H alom of formic acid is replaced by the group of form acetic acid. Chycooth the alkyl group will tend to increase the electron density on the oxygen atom of the high bond. Consequently the release of Hilliam in acetic acid will be more difficult as compared to formic acid. Apart from this, the methyl group will also destabilise the acetate ion by intensifying the negative charge relative to the formate ion.

Thus, the release of H* lost from acetic and will be difficult as compared to forme and or the former is a weaker act I in general, greater the +1 effect of the nikyl group attached to the car loxy, group, lesser will be the acidic strength of the carboxylic acid. The +1 effect of the alkyl groups increase in the order

$$CH_{a} < C_{a}H_{b} < (CH_{a})_{a}CH < CH_{a})_{a}C$$

Therefore, acetic acid. CH, COUH is a stronger acid than propionic acid. CH, CH, COUH which is still stronger than inobutyric acid. (CH,), CHCOOH and so on

Acidic strength decreases

(b) Electron withdrawing substituents. The electron withdrawing substituents such as halogen atom will tend to with law the electron charge when attached to the corboxylic acid at a specific position. Consider the example of chloroscepts and.

Chrome is an electron attracting atom. I in lactive effect) It withdraws the electrons from the carbon to which it is attached and this effect is transmitted throughout the chain. As a result the electrons are withdrawn more strongly towards bygger of O—H band and promotes the release of proton Consequency and strength acreases. Therefore, chlorocetic acid is stronger and than aretic and.

Further, because of electron withdrawing tendency of Cluttum 1 effect t stablises the carboxylate amon by dispersing the negative charge and therefore, strengthening the acid.

6. Effect of number of halogen atoms. The mountaine effect increases with increase in a unber of charme atoms and therefore, acidic strength also increases.

Acidio strength increases

Thus, the acidic strength decreases in the order

CCLCOOH > CHCLCOOH > CH_CCOOH > CH_COOH

4) Nature of halogen atom. The strength of carboxylic and also depends upon the nature of the electron withdrawing halogen atom. Freater the electron withdrawing influence of the halogen atom, stronger w if be the acid for example, the electron withdrawing effect. I effect of the halogen decreases in the order F > Ci > Br > I, therefore, the angle strength of manocarboxylic and decreases in the same order as

FCH,COOH > CICH,COOH > BrCH,COOH > ICH,COOH

Acidio strongth increases

**** Position of the halogen atom. We know that inductive effect decreases rapidly with distance. Therefore, as the distance between the electron withdrawing group and the —COOH group increases, the electron withdrawing influence decreases. Beyond a few methylene groups, the effect becomes negligible. For example,

Acidic strength increases

Is Effect of type of hybridssation of carbon atom bonded to "COOH group.

Direct attachmen, of groups such as phenyl or vinyl to the carboxylic and, tocreases the acidity of the corresponding carboxylic acid contrary to expected decrease because of resonance effect as abown below

This is bescuse of larger electronegativity of sp^* hybricised carbon m which carbony, group is attached. In general, activity increases as the electronegativity of the √ atom directly attached to − CUUH group increases or the hybridisation of the C atom directly attached to 4000H changes from $sp \to sp' \to sp$ For example.

As observed, benzoic and $p{
m K}_1$ = 4, 19) is a stronger and than arrylic and $p{
m K}_1$ = 4, 25, because the double bond. of a benzene ring is less electron donating since this delocalisation destroys the aromatic character of benzene. Thus, benzuic seid is a stronger and than arrylic seid,

Similarly, benzoir and is more addic than all the and because in benzoir and -COOH is attached to $sp^2 \cap$ atom: of the phenyl ring while in arctic and $-C \ll H$ is all ached to sp^3 in atom of methyl group. However, formic and does not contain any alkyl group and therefore, \uparrow is entanger and $pK_a=2.75$) than benzoic and Thus, the relative and strength of these three scide is

> Benzour acid Formic acid > Acetic acid

However, when a phenyl group is attached to a $-C \cup CH$ group through one or more saturated carbon atoms, phenyl group and a weak electron with rowing inductive effect. In Therefore, phenyl acetic and $\phi K_i = 4.31$ is singlely stronger acid than acetic acid $(pK_{\parallel} = 4.76)$.

Thus, in a pueshell

- the electron withdrawing substituents disperse the negative charge on earboxylate ion and stabilize it and thus, increase acidity
- the electron rescusing substituents intensify the negative charge of the carboxylate ion, destabilize it and thus, decrease the acidity.



Bruon and atrengtuens acid

EWG withdraws electrons, stabilizes — EDG receives electrons destabilizes amon and weakens occ

The effect of the following groups in increasing order of scidic strength is

Effect of Substituents on the Acidic Strength of Benzoic acid

Like suphatic ands, the aromatic scide are also affected by the substituents as discussed below

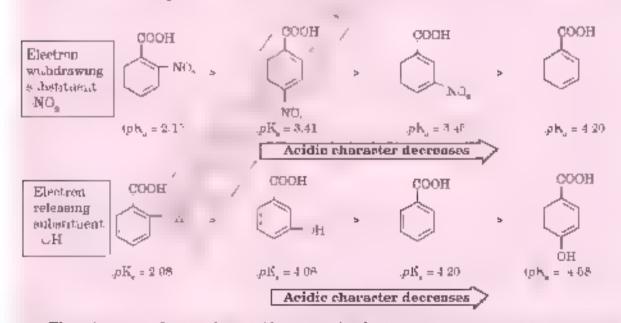
The electron releasing groups he CH, CH oCH and NH make benzon and weaker while electron withdrawing groups like Ci NO, etc. ander benzon, and stronger. Thus.

The substraigent effects on the script character of p-substituted benzoir acid. Y=

Electron relea	eing groups	E	Electron withdrawing groups			
Y	$\rho K_{_{0}}$		Y	$pK_{_{0}}$		
OH	4.58		OL .	4.0		
OCH	4.48	⊢	Br	3 96		
CH,	4.38	,	CHO	8.76		
NH_g	4.86		CN	8.55		
	Sanara sai	d oK = 4.20	NO.	5.44		

The acid weakening effect of the electron locating groups and acid strengthening effect of the electron withdrawing groups is more prenounced at p-positions than at m-positions. Thus, among p, and m-isomers.

p-isomer has more acidic churacter than m-isomer for electron withdrawing group. In the other hand, for electron retening group, the $-\Theta H$ group, m-isomer is stronger acid than benzoic need where p-isomer is weaker than benzoic acid. For example



to The or he some of every substituted beasan and a the stronges, acro among the turne somers, at matter whether the substituent is electron done angong. CH₀. H. NH₀ etc. or electron withdrawing a g., C. NO, CN POCR, ever This effect is caused **or tho effect.** It is mainly a continuation of both steric and electronic factors discussion is beyond the scope of present class.

The effect of substituents of the and strength can be explained on the mass if combined effect of inductive effect (D, resonance effect (B) and ortho effect. Some common examples of relative acidir strength of a, m and p-acids as compared to benzou acid are given below

Electron donating groups

	COOH		COOH		соон		COOH
Toluic acids	СН	>		>	CH.	>	
pK, values	4.00		4.20		4.24		CH 4 de
Hydroxybenzme acida	ОН	>	соон	>	COOH	>	COOH
pK, values	2.98		4 08		4,20		4 58
Aminobensoic acid	COOH	24	COOH /	>1	COOH	5	NH,
pK, values	4.20		4.72		4.60		4.95
Methury benzuir scida	COOH OCH,		COCH OCH,	5-	000H	٦	000H
ρK values Electron withdrawing	4.09 g groupe						
Nitrobenzoic scide	COMP	5	COOH	5	COOH NO,	٦	You H
pK, values	2 17		NO. 3.41		8.46		4.20
Chlorobenzere acade	C/H off	>	COOH	>	COOH	>	C.U.H
µK values	2,94		3.83		1.99		4 20

Comparison of Relative Acidic Strength of Monocarboxylic Acids, Alcohols and Phenols

a) Carboxylic acids and alcohols. Monocarboxylic acids are stronger acids than the monohydric alcohols. This is due to the fact that not be the carboxylic acids and the carboxylide ions are resonance stabilized and the carboxylide ions are resonance stabilized in comparison to carboxylic acid. Therefore, carboxylic acids have tendency to give H* ion forming stable carboxylate ion. However in alcohols no resonance is possible for the alcohol as well as alknowle ion.

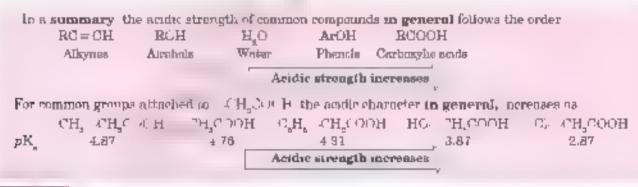
In fact, sicohois are very weak acids.

b) Carboxylic noids and phonols. Phonols are acidic because the phonox de ion can be stabilized by desocatisation of negative though into the ring. However, phonols are less where physical acids. It share carboxylin acids.

The difference in the relative acide strengths can be understood if we compare. The resonance hybrids of earboxylate on and phenoude ion.

The resonance hybrids may be represented as

The electron tharge in the carboxylate ion is nore happened in comparison to the phenate ion since here are two electronegative oxygen atoms in carboxylate ion as compared to only one oxygen atom in phenate ion. Moreover, the carboxylate ion is stabilised by two equivalent resonance structures in which the negative charge is on the more electronegative oxygen atom. However, phenoxiae ion has non-equivalent resonance structures in which the negative charge is also on less electronegative curbon from Therefore resonance in phenoxide ion is not as hiportanic as it is in carboxylate ion. In other words, the carboxylate ion is relatively more stable as compared to phenate ion. Thus, the release of H* ion from carboxylic acid is compared vely easier or it behaves as a stronger acid than phenox



SUMILP

On the basis of above for the common works are arranged in the following order of an dity cased on their μ K, values CF, both > Ch_COOH > Ch_COOH > CCH_COOH > CCCH_COOH > CCCCOOH >

The acidic character of carboxylic acids can be shown by the following reactions:

- 1. Action with blue litmus. A. carboxylic acids turn blue liter as red.
- 2. Reaction with metals. Carboxylic auxils react with active metals such as Na, K. Ca, Mg. Za, etc., to form their suits with the liberation of hydrogen.

Acebe ecid

3. Action with alkalies. Carboxylic and a neutralise alkalies forming saits and water CH_COOH + NaOH → CH_COONA + H_O

4. Action with carbonates and bicarbonates. Carboxylic scids decompose carbonates and bicarbonates evolving carbon dioxide with brisk effervescence

Sodium acetare

2 CH, COOH + Na, CO, + H, O Sodium sectate

CH, COOH + NaHCO, + CO, + H, O Sodium sectate

REMEMBER

Reaction of carboxylic acids with aqueous sodium carbonate socition—ones to exilition of carbon; thouside pool in ignorable effervences. The effect escence However most plannals do not produce effervences. The with aqueous source of sodium, unarbonate Therefore, this reaction may be used to distinguish between carboxylic acids and phenols.

It may be noted that diffring the reaction of corboxy is to ids with No.Co., or NaHCO, the carbot dioxide everyodromes from Na₂CO, or NaHCO, and not from carboxyl group as shown below

This is firstler appointed by the observation that when 54 Consider because and is treated with NaHCO₃, unlabelled CO₃ is produced

 $C_eH_e^{-M}COOH + NaHCO_e \longrightarrow C_eH_e^{-M}COONa + CO_e + H_eO$ **C-Benzoic acid** **Sodium benzoite**

B. Reactions involving the $-\Theta$ lit groop of the earboxy is needs involving cleavage of $C+\Theta H$ bonds

The -OH group of carboxylic actas can be replaced by a number of groups such as -O - IR, -NH, and -OOC R' to form oblandes, esters, and design of a typicales. These compounds are codestively called fractional demantices of carboxylic acids.

5. Formation of acid chlorides Reaction with PCI_p PCI_p or $SUCi_{p'}$ Carboxylic acids can be converted into acid homose by treatment with prospheries mades PCI_p or the myl chloride $SOCi_{p'}$ in pyrtuine. For example,

RCCCI + ROOCHI + PCL + POCI. And chioride Phoenhurus axionalomae arcoom. PGI. arcuct + H,PO, Agrid Bling de Ellicophina are agrid RCCOH acci. RCQCI 80, * HC Thomyl chloride Acid oblorida CH,COOH CH,COCL + POCL + HOL PCI. e.g., Acetic acid Acetyl chloride SCH.COOH SCH_COCI + H_PO_ PCL -Acetic seid Acetyl chlerode + BO, # HCI CH,COOH SOCL CH_COOL Acetae ecid Acctyl chlorade

6. Formation of esters Peacron with meanors) When carboxylic acids are heated with a cohole of the presence of concentrated H_0SC_1 or HCi esters are formed. The reaction is reversible in nature and is coded esterification. For example,

The reaction is shifted to the right by using excess of alcohol or removal of mater by the historia.

The rate of which a carboxylic acid is esterified depends primarily upon the scenic hindrance in the scrobol and the rarboxylic acid. The acidic strength of carboxylic acid is plays may a camor role of the rate of ester formation. Thus, the rescrivity of alcohol towards esterification increases as

tert-airchol < sec-airchol < pri-airchol < methyl airchol

Similarly reactivity of cerboxylic and increases as

R,CCOOH < R,CHCOOH < RCH,COOH < CH,CO H < HCCOH

ESTERIFICATION F ARE XIVE ACRES

The extensions of earboxylor acids with alcohols is a kind of nucleophshic acyl substitution renotion. The mechanism of extensions involves the following steps

Step. 1. A proton from the protonic and attacks the carbonyl oxyger of carboxylic and.

Carboxyle and , Protonated carboxylic and

Stop II. As a result of protonation, the carbonyl carbon gats activated and hence read, y undergoes attack by the ione pairs of electrons on the oxygen of an alcohol to form a tetrahedral intermediate.

Toresingles are encourage or

Step .II From the resulting intermediate to proton shalls to OH group to form another tetrahedral intermediate. During this proton transfer the H group gets converted into OH.* group.

Step IV. The attended at a distanced in Step III have a water molecule to form a protonated ester

Step V. The protonaceo ester loses a proton to form an ester-

The arechanism is supported by the fact that acetic and reacted with isotopically labelled echanoms $\mathrm{CH_sCH_s^{BO}H}$ to give enly accurac having all the labelled oxygen in the ester while water aid not contain any isotopic oxygen as

All the steps in the above mechanism are reversible.

7 Formation of armides Reaction with animona. Carbonyle acids react with appropriate form animonium saits which upon hesting form acid emides. For example,

8 Formation of need anhydrides. Action of hear x the presence of $P_{x^{*}}x^{*}$. Carboxylic acids on heating in the presence of a strong dehydrating agent such as absolutous pentionide. P.O. or H.SO. form corresponding act for hydrides.

Acti annydrides are asse formed by treating acto chlorides with carboxylic acid in the presence of pyridine as a base or by treating acid chlorides with sodium sales of carboxylic acids.

C: Reactions involving the parboxyl (-COOH) group

O Decarboxylation. Carboxylic acids get decarboxylated. a lose carbon dioxide under the following conditions or Sedium or potassium saits of carboxylic acids on heating with sods time. Nat H + lat in the ratio of 3: 1) give hydrocarbons which contain one carbon atom was than the parent acid.

It may be noted that carboxylic ands containing an electron withdrawing group such as —"== or NO, at β-carbon stom w.r.t the -COOH group, readily undergo decarboxylation on heating. For example,

When two carboxylic groups are attached to the same carbon alon, gen dicarboxylic and a OL-OOCH is present all β -carbon alon with A^*OOH group, decorboxylation takes place sumply on heating

b Electrolytic decarboxylation. Electrolysis of aqueous solutions of sodium or potassium sake of carboxylatic acids undergo decarboxylation to give arkones. This method is known as notice a electrolysis.

$$c.g.$$
, $2CH_{c}COOK \rightarrow 2CH_{c}COO' + 2K'$

A. another $2CH_{c}COO' \xrightarrow{2s} \rightarrow 2CH_{c}COO + CH_{c}CH_{c} + 2CO_{c}$

Unstable Ethane

A controle $2K' \xrightarrow{+2s'} \rightarrow 2K \xrightarrow{2H_{c}O} 2KOH + H_{c}^{-1}$

Decreases the control of column columns of fatty mode. When a control on the columns of columns of the columns of columns of the c

- Decomposition of calcium salts of fatty acids. When mornin salts of earboxylic acids are heated authorises are formed. For example,
 - is Distillation of calcium formate gives formaldehyde

Calcium formase

.) When calcium formase is distilled with calcium accrate acclaidehyde is formed.

(ai) When calcium acetate is distribed mone, acetane is formed

Colmum scourte

to t When eatermin formule is distriben with energian benzou el benzandenvide is formed

10. Reduction

(c) Partial reduction to alcohols. Carboxyla saids on reduction with athum aluminium hydride (LaAlH₄) or with hydrides in the presence of copper chromate. CoCr O_{μ} are reduced. This has been described by with discreme $|b_{\mu}H_{\mu}\rangle$ in detrahydroflato. This

NOTE:

in these reactions, C a group of carboxy brighten group as ned too CH.

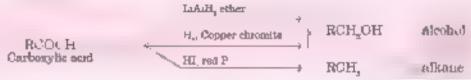
we Complete reduction to alkanes. Carboxylic ands on reduction with HI and red P give alkanes.

RCOOH + 6HI
$$\xrightarrow{\text{red } P}$$
 R—CH₃ + 2H₃O + 8I₃
Alkane

TH₃C-OOH + 6HI $\xrightarrow{\text{red } P}$ TH₃CH₃ + 2H₃C + 3I₃
Eltione

In the above reactions, the OOOH group is reduced to a OH, group-

Summary of Reduction



11. As term of browning in wither well of the need. The silver salts of the - choxylic and on treatment with Br₂ in the presence of CO_2 give alkylihables having one carbon along less than the parent and

The reaction is called Hunsdipoker reaction.

D: Reactions Involving Alkyl Group of Carboxyle Acids

12 Fin.ogenation. Carboxy-ic ands having an O-hydrogen react with chlorine or bromine in the presence of a sit-all and sit of red phosphorus to give compounds in which O-lydrogen atoms get replaced by halogen atoms. This reaction is called Hell Volhard-Zelinsky reaction.

Function of red phosphorus.

The function of recipies, which end combine with arounde to form PBr. This file reacts with corboxylic soid to form corresponding and brounds which enables to a larger extent than the and. Thus, it brings and co-bromination readily

The halogen atom in monosubstituted and can be easily replaced by a smooth atom or group to form a variety of compounds. Thus, to-halocra's are important sythetic intermediates. For example,

(t) Action with aqueous KOH

ai) Aerion with alcoholic ammunia

Glycine exists as NH₂ CH₂COO (dipolar ion

this Action with potassium cyanide

CH₂COOH + KCN
$$\xrightarrow{\text{Kri}}$$
 CH₂COOH $\xrightarrow{\text{Hr}}$ H₃O $\xrightarrow{\text{Hr}}$ COOH

CI CN / COOH

G-Cyano acetic and Maioric and

13 Ring substitution in aromatic acids. Carboxyl group in benzoic and is an electron withdrawing group and the effect of meta directing group. Court common electron substitution for resolution of benzoit and are

6 Bromination

in Sulphenation

COOH

$$+ cone.H_sSO_s$$
 $SO_sH + H_sO$

Benzoic acid

3-Sulphubenzoic acid

an Nitration

HOTE

It may be noted that curboxybe acids donot undergo Frieder-Crafts reprisons because

- (c) the corboxyl group is strongly deactivating and
- be countyst Alt 1, Lewis and gets bonded to the carboxyl group strongly

Lorenino Plus

Bromination and nitration of salicylic acid

Salrylic and contains both \longrightarrow H as well as * \bigcirc OH group. In free-ment with bromine water bromination or cone HNC, and H₂SO, rates for * COOH group gets knocked but residing decarboxylation. Both give α and p-products.

Salicylic acid
$$\begin{array}{c} H \\ & \otimes_{B_1} H \\ & \otimes_{B_2} H \end{array} \xrightarrow{B_1} \begin{array}{c} H \\ & B_1 \end{array}$$

$$\begin{array}{c} B_1 \\ & \otimes_{B_2} H \end{array}$$

$$\begin{array}{c} B_1 \\ & \otimes_{B_2} H \end{array}$$

$$\begin{array}{c} B_2 \\ & \otimes_{B_2} H \end{array}$$

$$\begin{array}{c} B_1 \\ & \otimes_{B_2} H \end{array}$$

$$\begin{array}{c} B_2 \\ & \otimes_{B_2} H \end{array}$$

These are characteristic reactions of -COUH group when present of or poto activating group such as OH or NH,

ACID DERIVATIVES AND THEIR COMPARATIVE. EACTIVITY

The OH group of carboxylic ands can be replaced by other atoms or groups forming a number of and derivatives such as:







Computition Plus

Acid derivatives are compounds obtained by replacement of "H group of earboxylic acids by other at his or groups of at his For detail refer Competition File Page 1937

The relative reactivity of different acid derivatives towards nucleophilic scyleobatitution reactions is

0 || || R—C - C1 || Acad elibrado



This order of reactivity can be called explained on the basis of relative basis strength of the leaving groups are C, in action along each R and R and R are included as R and R are called R and R are relative basis strength decreases as R and R are R are R are R and R are R are R are R and R are R are R are R are R and R are R and R are R are R are R are R and R are R are R and R are R and R are R are R and R are R are R are R and R are R and R are R are R are R are R are R and R are R are R and R are R are R and R are R and R are R are R are R are R are R and R are R and R are R are R are R are R and R are R are R and R are R are R and R are R are R are R and R are R are R are R are R are R are R and R are R and R are R are R are R are R are R are R and R are R are

Since a stronger base is 0 poor leaving group, therefore, the case with which these caving group leave decrease in the reverse order $-\varepsilon$ CF > H -0.07 > NH. Thus, the relative reactivities of these and derivatives decrease in the order and chloride > anhydride > ester > anide

USES OF CARBOXYLIC ACIDS

The important uses of carboxylic acids are

(a) Uses of methanous soid or formic soid)

- (a) It is used in leather tanning
- (ii) as coagulating agent for rubber latex in rubber industry
- (m) in textile dyeing and finishing.
- (rv) as an antiseptic.
- in medicine for the treatment of yout.



(b) Uses of ethanous acid (acetic acid)

- . It is used in the manufacture of rayon and in plastics, rubber and silk industries.
- (a) as a solvent
- .m) as vinegar in cooking and in food industry

(c) Uses of benzoic acid

- (a) Benzoic acid and some of its salts are used as urinary antiseptics.
- (a) Sodium saits of benzoic and is used as a food preservative.
- in) Its esters are used in perfumery
- (d) 1.2- and 1, 4-benzene dicarboxylic acids are obtained by the andation of -2 and 1/4 dimethyl benzenes respectively -1/2-benzene hearboxylic acid phonair acid is used in the manufacture of phonair zero and resms and 1, ±-benzene dicarboxylic acid terephthalic acid as a basic raw material for polyesters
 - e) Hexane-1,6-dious send is used in manufacture of nylon-66.
 - (i) Higher fatty acids are used in the manufacture of scape and detergents.

DISTINCTION BETWEEN ALCOHOLS, PHENOLS AND CARBOAY L. ACIDS

	Test	Accohols	Phenols	Carboxylic acids
	Action on literas Reaction with sodium bicarbonate NaHCO _a)	No reaction No reaction	Turn blue literas red No resetue	Than blue little is red Give effervescence one to the evolution of CO
9.	Reaction with sodian hydroxide has H	No reaction	Form sa.ta	Form salta
4	Reaction with FeC 3	No reaction	3: diameteració colore, tiolet blue red, etc.	Some and a give prempitates e.g. "H _a with given hid? coloured ppt

DISTINCTION BETWEEN SOME PAIRS (CHEMICAL TESTS)

1. Formic acid and acetic acid

Formit said gives adver marror test www Tallen e reagent, whereas aretic acid does not give this test.

(a) Formic acid gives white ppt with mercuire characters solution.

Arche acid does not give this test

2. Acetic acid and acetone

Acetor and reacts wid NaHC∪_s to give effervescence due to the evolution of CO_s

Acetone does not give effervescence with NaHCO...

Acetone reacts with alkanne so, aron of ridine of give yellow ppt like to the formation of riddoform. Acetic and does not give this test

Acetor e also gives arange coloured ppt with 2. 4-Dimitrophenyl sydrazine while acetic send does not

3. Phenol and benzoic acid

Benzor acid reacts with NaHCO, to give efferverence due to the evolution of CO_{+}

$$C_aH_aCOOM + NoHCO_a$$
 + $C_aH_aCOON_A + H_aO + CO_a$

Phenol does not give effervescence.

Phenol gives violet colour with FeG, solution by benzoic and does not give such colour.

ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

4. Ethanol and apetic seid

Acetar acid gives effervewence with NaHCO, due to the liberation of CO.

CH,COOH + NaHCO,

→ CH,COONa + H,O + CO,

Ethanol does not give effervescence with NaHCO,

Ethanol gives yellow ppt with admine solution of I, while acetic and does not give this cest

CH_CH_OH I2, NaOH OH + HCOONs

Yellow pot



39. How will you prepare

ethy bromide from propionic and

ethyl propanosts fr an propanous and

en acetane from acetar and

bens orosaned areal from beassion and

(v) chiomacatic and from mathyl chlonde

50. Which bond C-OH or CO-H of carboxylic acids is broken when

(a) and chloride is formed

(b) acid reacta with zinc

(e) acid reacts with NH, to form amide-

■ Ans. a C—OH

b CO-H

(e, 00-H

81 Which of the following is a stronger scid in each of the following pairs?

CH, CI COUH, CH, FICOOH

ъ съ исијенјеоон, сијенстен, гоон

и си,соон с,и,си,соон

W. W.N. "C"H"COOH b-NO"C"H"COOH

p-NO₂C₂H₂COOH, C₂H₂COOH

n m-OHC,H, OOH p-OHC,H COOH

Answer CH, F)COOH

b "H_sCH_sCh_sCh_sCOOH d p-NO_sC_sH_sCOOH

C'H'CH'COOH

a post, car, took

.e) p-NO₀C₀H₄COOH

√ π-OHC,H,COOH

83. Arrange the following in the increasing or or of space strength

CICH, ROOH

CALCH_a TIPH COOH

C FCH_COOH

POSTH_COOH

Ans. tiv. < tip. < to < to ...

SOLVED EXAMPLES

Example 19—

Name the reagents in the following reactions.

$$0 \quad CH_s \quad CO + CH_s \quad \stackrel{1}{\longrightarrow} \quad CH_s \quad CH + CH_s$$

D.S.B 2015

OH

$$a = C_d H_d + C H_d + C H_d = \frac{2}{3} + C_d H_d COO K^*$$

D.S.B 2015

 γ_{B_s} CH_s $CO-CH_s$ $\stackrel{?}{\longrightarrow}$ CH_s $C-CH_s$

(A.J.S.H. 2018.

 r_{00} CH_COOH $\stackrel{7}{\longrightarrow}$ CICH_COOH

(A.I.S.B. 2015.

So. atron (i) Lathium simminum hydride, LiA.H.

(i) A.kaline potassium permanganate, KMnO., KOH

finitCH, Mg Br, H,O*

tro, Cl., P (Hell Volhard Zehnsky reaction)

Example 20.

Preduct the products of the following reactions

(a)
$$CH_s = C = O \xrightarrow{\text{FigN NHy}} CDSB 2015$$

$$C_0H_0COCH_1 \xrightarrow{N_0OH_1L_1} COCH_2$$

$$f_{C_s} C_s H_s C H_s \xrightarrow{(\alpha, RMnO_4/ROH)} (A.I.S.B. 2015)$$

Solution 'a
$$\cap H_s$$
 $C = \cap$ $\cap H_g \cap H_{g_{-1}} \cap H_g \cap H_g$

$$O_{\mathfrak{g}} \to \mathcal{O}_{\mathfrak{g}} + \mathcal{O}_{\mathfrak{g}} \to \mathcal{O}_{\mathfrak{g}} + \mathcal{O$$

$$\begin{array}{ccc} tc & \mathcal{S}_{a}H_{a}CH_{a}CH_{a} & \xrightarrow{to} & \frac{KMnG_{a}-KOH}{to} & C_{a}H_{a}CCHJH \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & &$$

$$d CH_{h} = C = 0 \qquad \text{HCM} \qquad dH_{h} = C + CM$$

$$P$$
 + NaOH CaD + Senzene

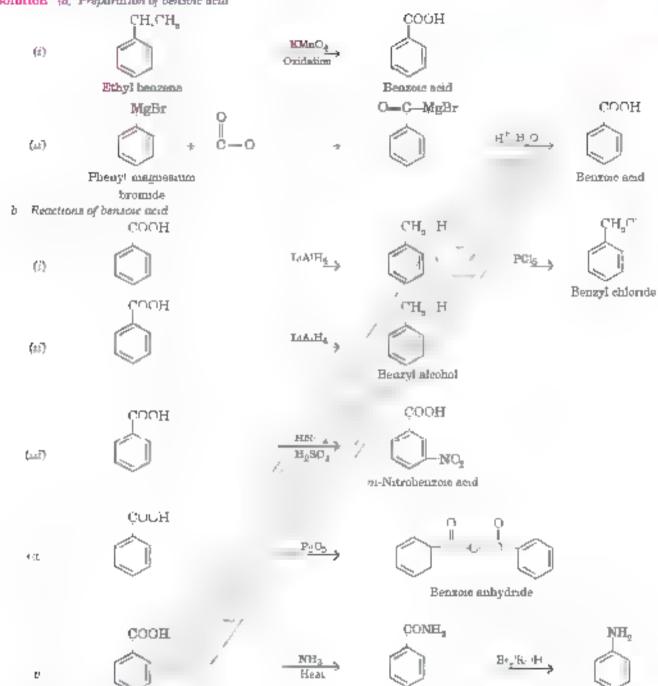
☐ Example 21.

- ,a. Discuss the reactions for the preparation of benzoic acid
 - 4. from ethyl benzene (a, using Grig nard reugent
- To Hou is benzoic acid converted into
 - 1. benzyl chioride (h. benzyl awohol in, mela nitrobenzow and (w., benzow anhydride
 - to andine T

ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

Anume

Solution (a, Preparation of bensoic acid



□ Example 22a

Predict the organic products of the following reactions

$$CH_{*}CH_{3} \xrightarrow{KMnC_{4}} COO(H_{3} \xrightarrow{SOO(_{2})} COO(H_{3} \xrightarrow{SOO(_{2})} COO(H_{3} \xrightarrow{COO(H_{3})} COO(H_{3} \xrightarrow{COO(H_{3})} COO(H_{3} \xrightarrow{SOO(_{2})} COO(H_{3} \xrightarrow{COO(H_{3})} COO(H_$$

 $L.S\,B.\,2010$

So. atron.

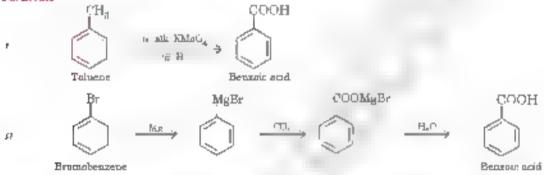
Example 23...

Describe how the following conversions are current our

- . Tomene to benzone next
- A I S B. 2018
- n. Ethyleyanide to elhanoic acid

- to Bromowan in to besison and
- he Buton I or to butanose acid

So. aftun.



- . $CH_1CH_2CN \xrightarrow{H_2O} CH_2CH_2CONH_3 \xrightarrow{P_1 \cdot W \cdot E} + CH_2CH_2NH_3 \xrightarrow{H_2O} CH_2CH_0OH \xrightarrow{|D|} + CH_2COOH$ Sther counds
- (sv) CH₂CH₂CH₂CH₃OH (ShhO₄) CH₂CH₂CH₃COOH

 Butanoic acid

Example 24 —

How will you convert acetic acid to

maloner and a colony alcohol gigane are designed anhymmeter?

Solution

1) Aerhe and to majoric and

(st, Acetic acid to tert-butyl alcohol.

test butyl alrohol

ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

an) Acetic acud to glycine

(ac) Acetto acid to acetylene

vi Acetic acid to ethylomine

Example 25—

How will you make the following conversions ?

- 4. Proprouse and to deep and
- Proproma acid to lange and
 - W. Ethannic acid to propancie acid.
- in Propins and to copropyl account
- v. Ages new orthered

Megnanaya S.B. 2018

for Ethene to succence acid

Solution

Propionie acid to acctic acid

(11) Propionic acid to isopropy, alcohol

an) Propionie acid to luctic acid

(v) Ethomnic and to proponoic and

eil) Ethene to sween and

□ Example 26_m

Write the structures of A, B C and D in the following reaction

$$CH_2CN \xrightarrow{SnC_2 + HC1} A \xrightarrow{dG,N_0 \cup B} B \xrightarrow{hora.} C$$

$$\downarrow^{HCN}$$

$$D$$

(A.LS.B. 2018)

Solucion

Example 27...

Write the structures of A, B, C. D and E in the following reactions:

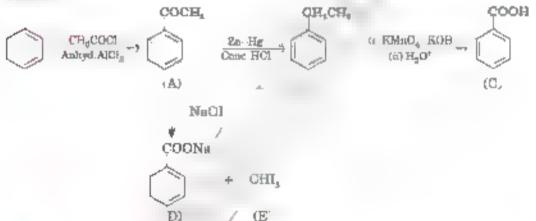
$$O_{g}H_{g} \xrightarrow{CH_{3}COC!} A \xrightarrow{Z_{D} \cdot H_{2}^{2}/Conc.HC!} B \xrightarrow{KMnO_{g} \cdot KOH_{g}, h} C$$

NaOI

 \uparrow
 $D + E$

D.S.B 2016

Solution



add on

Conceptual Questions === 2 ====

- Q.1 Aromatic carboxylic acids do not undergo Friedel Crafts reaction. Explain. (A.I.S.B. 2018)
- Ans. Arometic contraytic ands do not undergo Frieds' Crafts reaction because 4°C8 H group is describenting and the catalyst aluminum chloride (Lewis and) gets builded to the carboxyl group.
- Q.2. pK, value of 4-nitrobenzoic acid is lower than that of benzoic acid. Explain.

(A.I.S.B. 2018)

- And Due to the presence of strong electron withdrawing. No group in 4-mitrobenzous and it stabilises the carboxylate anion and issues strengthess the anid. Therefore, 4-mitrobenzous and a more andir than benzius and and its pR, value is lower.
- Q.5, Write the IUPAC name of
 - (i) HOOC-COOH #0 COOH-CH₀-COOH

'Hr. S.B. 2010)

Ans. 1, Ethanedior and (a Propagedior and

Q.4. Why are the boiling points of earboxylic acids higher than the corresponding alcohols?

- Ans. Corboxylic acids here eigher boiling points then excelols of comparable molecular messes. For example, the boiling point of ethanoic and is Sel K whereas that of propages is 37. K both have molecular mass = 89. The higher bound point of rerboxylic and as compared to alrebox is due to greater hydrogen bonding in ande than in alcohols. As a result, the molecules of carboxylic acids are held together by, we hydrogen bonds and have more attractive force and therefore, have higher boiling points.
- Q.5. Carboxylio acids do not give the characteristic reactions of carbonyl group. Justify

Pb. S.B. 2018, 2015,

Ana. Corboxylic ands do not give the characteristic reactions of carbony group $\mathcal{A}=\mathcal{G}$ as given by adebytes and ketages. In carborrius ands, the carbonet grants is involved in resonance, as follows:

Therefore at is not a free group. But no resonance is possible in aldebydes and betoner. They give the characteristic reactions of the group.

Q.5. Formir acid reduces Tollan's reagent. Explain.

- Ans. Formic soid has sudehydic group, H—C. OH and, therefore, is ready, undised. Thus, it reduces Tollen's reagent
- Q.7. Me,CCH,COOH is more soldio than Me,BiCH,COOH.
- Ans. Silicon is electropositive than carbon and therefore has more electron domaing effect.

As a result, the auton Me,SrCH,COO compagete base, becomes assectable than Me,CCH,COO. Thus, Me,CCH,COOH. is more serdic than Me, SiCH, COCH.

- Q.S. Acetic sord can be belogenated in the presence of reil P and Cl, but forms and cannot be belogenated. in the same way.
- Acetic end is hologerated in the presence of red P at which substitution occurs at a-courbon atom. This is known as Ans. Hell Voluland Zelmaky reaction

However formic scid HCOOH has no c-bydr-gen stom and therefore cannot undergo HVZ resofton.

Arrange the following in the decreasing order of acidic strength (a) H,O, CH,OH, C,H,OH, CH,COOH

(H.P.S.B. 2010)

(b) CH,CH,COOH, HOCH,COOH, C,H,CH,COOH, CICH,COOH

H.P.S.B. 1016

- a THICOCH SIGH, HIS BUT SOH, OF A MOH, NOOH SOHOH, COOH SOH, COOH SOH, CH, CH, CH, COOH Why is the bond length of (= 0 in curboxylic acids slightly larger than that in aldehydes and Q. . O.
- ketones?

H P S.B. 2016)

Carborylic and has resonance structures Age.

Because of resonance arricture Π_{i} , where is some single bond character in C = 0 bond, thereby making it longer than in earlienyl compounds , aldehydas and katmes).

Q.11. What is glacual wetle acid? Why is it so named?

- 190% assur and which is free from water is relied glasm, aretic and. The melting point of pure onhydrons aretic and is 17°C. It is solid below this temperature and looks like 'icy' i.e., glamai.
- Q.13. Complete the following:

(Hr. S.B. 2013)

Q.19. Arrange the following compounds in the increasing order of their sold strength a CH_CH_CH(Br) COOH, (b) CH_CH Br CH_COOH, (c) CH_) CHCOOH, A CH_CH_CH_COOH

- e. Benzote seid (b. p-nitrobenzote seid e) 3, 4-Dinitrobenzoie seid d) 4-Methoxybenzote seid (D.S.B. 2008, CBSE Sample Paper 2011,
- Ans. (i. Increasing order of and strength
 - e CH_{a/a} CHCOOH < d CH_aCH_aCH_aCOOH < b CH_aCH Br CH_aCOOH < a0 CH_aCH_aCH_aCH_aCH GOOH
 - . Id 4-Methoxy benzon acid < a Henzoic acid < 15 4-Nitrobenzoic acid < 16 4 Dimitrobenzoic acid
- Q.14. Name A and B in the following reactions:

COOH
Majoure neid

NH, Glycine



Key Terms & Name Reactions

- Carbonyl compounds. The compounds containing carbony: group (32 O such so aidenydes and ketones are called carbonyl compounds.)
- • hydrogen. The sydrogen ettached to the carbon atom next to rarbonyl group tell. C+O. C+O. CODH.
- Waoker process. Askenes can be converted into aldeayons and ketones by treating with acidited aqueous solution of PACL containing PoCL in the presence of air or mygen.

 Reseasanted's reduction. And character are renverted and adenydes by calculate hydrogension at the presence of policit in Pd consists supported over been in an obote. The consists market is poisoned by the add for of a small amount of sulphar or quinoline.

Stephen reduction Askyl systems: or number when reduced with stemmus chiteride and hydrocluons and a sheomies ether followed by hydrodysis give addeligates

$$CH_{1}C = N \qquad \bullet \qquad 2H \xrightarrow{\text{SoCi}_{1} \cdot \text{Horizon}} \quad 2H_{1}CH = NH \xrightarrow{H_{2} \cdot \text{Horizon}} \quad 2H_{1}^{-2}HC + NH_{2}$$
Ethanol

Etard's reaction. Alkyl conzense can be analised to be availably de with chromyl chioride CrO,Cl, in Crl, or CS.

 Gattermann Koch sidehyde synthesis. Bonzaldehyde a prepared by treating a modure of PC + HCl with benzene at 328 K at the presence of annydrous AfCL or cuprous chior de caselyst

Resembly Tiermann reservors. Phenoise addenyels are obtained by treating phenois was: "HCl, or aqueous NaOH.

 Haloform reaction. Aldebydes and ketones paring at least one methyl group anked to the carbonyl carbon are easily exidiaed by codiam hypoholise solution to give chieroform accodeform ac aromoform

Clemmensen reduction.

Wolff Kishner reduction.

 Aldel condensation. Adebydes and keloner contouring at least one (strydenger). His pame attached to the Pottou adjacent to the carbony) group, undergo self-condensation in the presence of discussible in form \$\textit{B}\$-tiyalmay analysis aldof or B-hydroxy ketone ketol respectively

 Cannissarro's reaction. Adebytes which do not constant any subgrouped about such as formaldebyte. HCHO and senzaldehyde ".H.CHO undergo seif oxidation and reduction reaction on treatment with concentrated alkan. In this recention, one analysade to exidend to and vehilo another to reduced to atrebal.

 Claisen Schmidt reaction. The reaction of randomeshop between an ecometic aldehyde or ketone and an alighetic addenyde or kenne in the presence of dilute alknown form in \$ ansaturested compound.

Benzeidetrede (no-e-bredrogen)

- Acetylation. The process of replacement of an active hydrogen of alcohole phenois or amines with early group to form entreaponding esters or emides
- Describes yintion. The process of removal of a motocule of ²⁰ a from a carbosyle across
- Koch reaction. Conforming other presents of a register of the conforming of the conformin with H_PO, at 578-676 K.

$$\mathbb{R}^{n}H = \mathbb{H} * \mathbb{M} * \mathbb{H}_{n} \mathbb{H}_{n} \xrightarrow{H_{n}PO_{n}, 0.74, 0.75 \mathbb{R}} \mathbb{R}^{n}H_{n}, \mathbb{M} \circ \mathcal{H}$$
Alkene

 Russdoecker reaction. Bilver saits of carboxyta, made no treatment with Br., in the presence of COL give alkyl naides baving one C atom less than the parent and.

Heli Volhard-Zehnsky (HVZ) reaction. Reaction of carboxylic acids having a hydrogen arom

QUICK CHAPTER ROUND UP

Preparation of Aldehydes and Ketones

Oxidation of alcohole

Hydration of alkynes

RC=CH

$$\text{HC=CH} \xrightarrow{H_2^{\text{SC}_4}} \text{CH}_1^{\text{CHO}}$$
, $\text{CH}_1^{\text{C}=\text{CH}} \xrightarrow{\text{GSC}_4} \text{CH}_1^{\text{C}} \text{CH}$

 $\xrightarrow{B_0H_h}$ RCH=CH., B

Hydroboration of alkyoes

From references saids

Wacker Process

Hydrolysis of gent dihabides

Preparation of Aldehydes only

Reduction of seid chlorides.

Reduction of siky! oyanides

$$CH_1C=N$$
 + \underline{CH} $\xrightarrow{SeC_2^{-1}HC}$ $CH_1CH=NH$ $\xrightarrow{H_1C^{-1}}$ CH_1CHO

Prom aromatic hydrocarbon.

Preparation of Ketones only

From soyl handes

From nitriles by Grignerd reagent

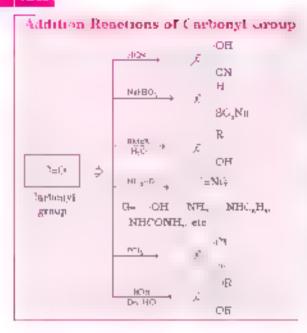
From beazene or substituted beazene

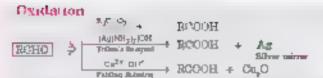
From phenyl esters (Fries rearrangement

Reactions of Aldehydes and Ketones

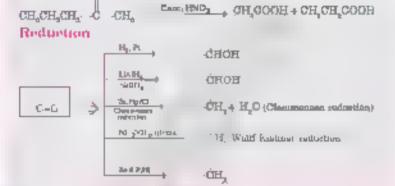
Undergo nucleophylic addition reactions.

Kenc av 19





Recuper to See despute conditions are usableed a captoryl, and with rupture of bond between surbacyl C and &-D. In maynimetrical betones, ourbusyl group is retained with amaller alkyl group.



CARBOXYLIC ACIDS

Preparation of Carboxylic Acids

· Oxidation of alcohols

RCH,OH

→ RCHO

+ RCOOH

Oxidation of aldebydes and ketones

воно о ч вооон

H, SKNH, A- SCH,COOR

Originant rangem

Byrtrodyala

RCN + 2H₁O ^{15', CHF} + RCOOR

ROODS' + B.O H'.CON ROOOH + M'GOOH

RCONH_i + B_iO → RCOOR

(CH,CO),O __HO__ SCFLOOOH

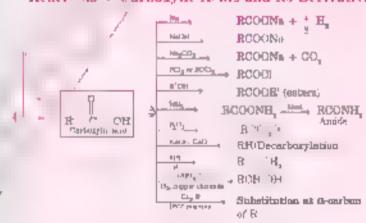
Carboxylation of alkenes

OB_OB_OB_+ OO + B_O HANA CH,CHOOOH
Aroundto scids CH,

By passing 00 on sodium alkowide.

R-ONe + CO Hau BCOONE H' RCOOH

React this of Carboxylic Acids and its Derivatives.



- Aromatic curboxyles saids undergo electrophilis, substitution reactions in which carboxyles group acts as a descriveting and meta directing group
- □ They do not undergo Priedel Crafts reaction.
- Effect of substituents on acode strength of acode. In general
 electron withdrawing groups (EWG) mercase the stability of the
 carbonylate ion by delocalising the negative charge and hence
 acrease the acodity of the carbonylar acid. Conversely electron
 docating groups (EDG) decrease the stability of the carbonylate
 ion by intensifying the negative charge and hence decrease the
 scribity of the carbonylic acid.
- □ The electron releasing groups like CH_p OS. OCB_p and NB_p make beautic with weaker white electron withdrawing groups like CL NO_p etc., make beaution and stronger
- The majo counter if every most meet without such a reason electron releasing or electron withdrawing) in the strongest acid aming the three sections due to effect known so ortho effect.
- Among p- and m-numers, p-numer has more acidic character than m-conner for electron withirrowing group. On the other hand, for electron releasing group like —OH group, m-isomer is stronger and then because and while p-moner in weaker than because and.
- Phennis are less acidic (pK, is shout 16) than earborylic acids.







In-text Questions



Q.1. Write the structures of the following compounds:

- i) a-Methoxypropionaldehyde ii) 8-Hydroxybutanni
- ini) 2 Hydroxycyclopentanecarbaldehyde

- (iv) 4-Oxopentaned
- c) Di-sec-butyl ketone
- (cv) 4-Pluoroneetophenone

Ans.
$$CH_1CH-C-H$$

COCH,

Q.2. Write the structures of products of the following reactions

$$O = C_2H_0 \xrightarrow{C} CI \xrightarrow{Anh_2d_1AIC_{1_2}} CS_3$$

$$(a) = C_8 H_q C H_{2'9} C \delta + 2 C H_q C C C I$$

Ans. i)
$$C_2H_5C_2C_1$$
Anbyd AlCl₂
 C_2H_6
Proprophenius

$$M = \mathbb{Q}_q H_q \cap H_q \cap \partial + \mathbb{Q} \cap g \cap \nabla f \cap \nabla$$

Q.3. Arrange the following compounds in the increasing order of their boiling points

си,сно, си,си,он, си,оси,, си,си,си,

Ans. The molecular mass of all base four compounds are comparable. CH_CH_044. CH_CH_0H_40. CH_CH_40. CH_CH_CH_44. CH_CH_40. CH_CH_64. Among these CH_0H_0H_40H undergoes extensive intermolecular H-bonding and it exists as associated molecule and hence its boiling point is he highest SF. K. CH_0H_0 is more point han CH_0CH_9 and herofore, dipole-interactions are stronger in CH_0H_0H_3. Hence he boiling point of CH_0H_9 is higher than that of CH_0CH_1 in CH_0CH_2, where are only weak van der Wasia forces and sense is sooling point is the lowest. The correct order of increasing order of brilling points is

- Q.4. Arrange the following compounds to increasing order of their researchy to nucleophilic addition reactions:
 - d) Ethanal, Propagal, Propagone, Butanone
 - ii) Benzaldehyde, p-Tolunidehyde, p-Nitrobenzaldehyde, Acetophenone

Ans. As we move from otherm to propount to propounce to buttanone, he all inductors effect of sixyl group increases. As a result, the average on the carbon state of the carbonyl group progressively decreases and hence strack by nucleophile becomes slower and slower.

Thus, the reactivity increases in the order

butanone « propanone « propanal « ethenal

 Among these compounds acatophanone is a ketone while all others are aldehydes, therefore acatophanone is least teactive In p-contaidebyde libere is a methyl CH₂ group at the carbony position with the carbony, group which undreases electron density or decreases two charge on the carbony tox carbonyl group by hyperconjugation effect thereby making it less reactive than benzaldebye.

On the other hand, as p-benzandebyde the NO, as an electron withdrawing group. It withdraws electrons, both by inductive and resonance effect thereby decreasing electron density or increasing the charge on the carbon of the curbonyl group. This facilitates the masses of the nucleophile and hence makes to more reactive than benzaldebyde.

Therefore, the correct order of reactivity is

acetophenoae < p-talualdebyde < bezzaldebyde < p-aitrobeazaldebyde

Q.5. Product the products of the following reactions :

7
$$O + HO = NH_1$$
 $O + NH_2 = NH_1$ $O + NH_2 = NH_2$ $O + CH_2 = CH_2$ $O + CH_3 = CH_4$ $O + CH_4 = CH_5 = CH_5$

Cyclohesanone-2,4-dinitrophonylhydrusone

Q.8. Give the IUPAC names of the following compounds

Ann. (i) 3-Phenylpropanoic acid

2-Methytryriopentanecarboxyttr acid

(ii 3-Methylbut-2-mor and " E.A.S. Finiterobenzon acid

Bromnbengone

Q.8. Which sold of each pair shown here would you expect to be stronger?

- of CH,CO,H or CH,FCO,H
- (iii) CH,FCO,H or CH,ClCO,H

Ana CHLECOLH

A THEOREM

(iii) CH_CHFCH_COOH



Textbook Exercises



- Q.1. What is meant by the following terms of Give an example in such ouse.
 - (ii) Cynnohydrin
- vii) Bemicarbazone
- (iii) Heminectal
- (ap) Retail

- (e) 9,4-DNP-derivative(el) Axial
- (a/d) Acetal
- (et/) Oxime

- (x) Imme
- (a) Somiff's base
- Ans. The compounds containing hydroxy and cyano groups on the same carbon atom are called **cyanohydrins** These are obtained by the addition of H N to a carbonyl group in weakly basic madium.

 Semicarbaxones are the derivatives of aldehydes and ketones obtained by the action of semicarbaxide on them in weakly action medium

$$CH_{9} \longrightarrow C + H_{1}NH \longrightarrow C \longrightarrow NH_{2} \longrightarrow PH 3.5 \longrightarrow CH_{8} \longrightarrow C \longrightarrow NNHCNH_{2}$$

$$CH_{9} \longrightarrow C \longrightarrow NNHCNH_{2} \longrightarrow CH_{8} \longrightarrow C \longrightarrow NNHCNH_{2}$$
Acctone semicordination

These are used for dentification and characterization of sudshydes and ketones

Gem-alkazy ecohols are caked beamsoctols. These are obtained by the addition of the molecule of unmultydate alrelial
an aldebyde to the presence of dry HCl gas.

4 Geni-dialkoxy alkanes are railed ketals. In these compounds the two alkoxy groups are present on the same carbon within the chain. These are produced by the reaction of ketone with athylene glycol in the presence of dry He'l gas.

These are readily hydrolyzed by dulate numeral acids to regenerate the original ketones. Therefore, ketais are used for the protection of keto groups in organic synthesis.

2.4-Dinitrophenyl bydrozones 2.4-DNP derivative are produced when aldebydes or ketones read with 2.4-directrophenyl
bydrozone in weakly andic medium.

Aldola are β-nydroxyaidehydes or ketones which are produced by the toudenseand of two molecules of aidenydes
or ketones containing α-nydrogen atoms at the presence of a dilute aqueous uses.

Acetal. These are districtly compounds in which we alkney groups are present on the terminal carbon acom. These are produced by the action of an aidebyde with two equivalence of a monopydric sicolol in the presence of dry Holl gas.

co. Oximes are formed when aldehydee or hetones react with hydroxyl ammes in weakly audio medium.

(ax limines. These are the compounds containing—CH=N—group and are produced when aidshyes and ketones react with ammonia derivatives.

Schiffs base. Aidebydes and ketones react with primary aliphatic or aromatic amines to form azomethines which
are also called Schiff's bases.

Q.2. Name the following compounds according to IUPAC system of nomenclature

- (d) CELCH(CEL)CH_CH_CEO
- to CH,CH=CHCHO
- on CH,CH(CH,)CH,COCH,4,COCH,
- (pii) OHCC,H,UHO-p
- Ann. (f. 4-Methylpeniana).
 - and But-2-enal
 - (v 8,3,5-Trimethylhexan-2-one
 - (cui) Benzene 1,4-dicarbaldehyde

- и си,си,соси,с,и,лси,си,си
- (te) CH_COCH_COCH_
- two (CH,),CCH,COOH
 - o del blom-4-ethylheran-9-noe
- to Penuane-2,4-dione
- er 3.8-Dimethylbutanore and

Q.S. Draw the structures of the following compounds

- (i) 8-Methylbutanal
- an) p-metbylbenzaldehyde
- (v) 4-Chloropentan-2-me
- (etf) pa-Dahydroxybenzophenone

- ii) p-Nitropropiophenone
- (in) 4-Methylpent-3-en-2-one
- ter 3-Bromo-4-phenylpentanois acid
- .c/ri Hex-2-en-4-ynote acid

Ans. CH₀. CH CH₀. CHO

 $CH_{\mathbb{B}}$

Q.4. Write the IUPAC names of the following ketones and aldehydes. Wherever possible, give also common names.

- (i) CH,CO(CH, CH,
- бі) СН,СН,СНВ-СН,СНССН,ЭСНО
- m) CH_c(CH_c),CHO

(ef) PhCOPh

Methyl n-penty) keteno

8 8 4 8 2 1 CH₂CH₂CHCH₂CH CHO

> 4-Bromo-2-methythemeno 7-Bromo-4-biethytraphaldebyte

. CHO

Eyelopensanecarbnidobyde eyelopensane sizbaidelayde С_пн_сСН = СН - СНО
 3-Ръе путрегор-3-есто

(B-Pliety) amoleur

or PhC-OPh
Diphery Bertalione
Benzaphmone

Q.5. Draw structures of the following derivatives

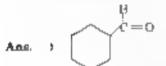
- (i) The \$4-dimitrophenylhydraume of benzaldebyde (ii) Cyclopropanone oxime
- iril) Acetaldehydedimethyloceial

- (r) The semicarbazone of cyclobutanone
- (v) The ethylene ketal of bexan-3-one
- (el) The methyl hemacetal of formaldakyde

- Q.6. Predict the product formed when cyclohexanecarbaldehyde reacts with following reagents
 - (I) PhMgBr and then H,O+

- (id) Tollen's reagent
- rif) Semioarbaside and weak and
- (iv) Excess ethanol and acid
- (1) Zine amalgam and dilute hydrochloric soid

NO_o



ASNINHEMITA

Servicerbazide

Cyclobacomeeurboldebys(e easurearbazane

Methyl cyclohexane

- Q.7. Which of the following compounds would undergo aldol condensation, which the Canazzaro reaction and which neither? Write the structures of the expected products of aldol condensation and Canazzaro reaction.
 - (ii) Methanni
- (iii) 2-Methylpentanal
- (iri) Benzuldehyde

- an) Benamhennne
- (a) Cycloheannone
- (pi) 1 Phenylpropanone
- (99) Phenylacetaldehyde (992) Butan I-ol-
- us 2,2-Dimethylbutanal
- Arts. 2 Methylponium. 1 a evelohexamene en 1 Phanylproperana and en phanylacetaidahyde contem one en more co-hydrogen atoms and therefore, undergo aldel condensation

But-2-enour acid



Q.9. Write structural formulas and names of the four possible aldol condensation products from propanal and butanal. In each case, indicate which aldehyde served as nucleophile and which as electrophile.

Ans. .. Propanal as electrophile as well as nucleophile

a. Propanal as electrophile and butanal as audeophile

in Butanal as electrophile and propanal as nucleophile

sir Butanal as electrophile as well as nucleophile

Q.10. An organic compound with the molecular formula C₁H_mO forms 2.4-DNP derivative, reduces Tollens' reagent and undergoes Cammizzaro reaction. On regorous exidation, it gives 1,2-benzenedicarboxylic acid, Identify the compound.

Ans. The given compound forms 3.4-DNP demostry. Therefore, it is an aidehyde or ketone. Since it reduces Tollen's reagent it must be no aldehyde. The compound indergoes Commizzant's reaction, so it does not contain thelydrogen. On vigorous oxidation, it gives a 2-ton rendicarboxylic and, it means that it must be containing alky group as 2-position, with respect to CHO group on the sensene ring.

- Q.1. An organic compound. A) (molecular formula C₁H₂O₂) was hydrolysed with dilute sulphuric acid to give a carboxylic neid (B) and an alcohol (C). Oxidation of (C) with chromic acid produced. B'. (C. on dehydration gives but 1-ene. Write equations for the reactions involved.

 A.I.S.B. 2009)
- Ans. a Since the given compound on hydrotysis with thi H,SO, gives carboxylic acid B and an electron C at must be an ester
 - b Since the audition of alcohol C gives the and B therefore both the carboxytic and B and atcohol C must contain same number of C atoms.
 - c Since ester A constante 8 carbon stoms, therefore both carboxylic and B and the straint C must contain 4 C stoms such
 - d' Alcohol 'C' on dehydration gives but-1 ene and therefore C must be a straight chain alcohol i.e. butan 1-of
 - B is obtained by the oxidation of 'C' and therefore, B must be butanous acid.
 This size suggests that the easer. A must be busyl butanouse. The relevant reactions are:

$$\begin{array}{ccccc} \mathbf{CH_0CH_2CH_2COOH} & \xrightarrow{\mathbf{CeO_3/CH_3COOF}} & \mathbf{H_3c^+L_2CH_2CH_2coH} & \xrightarrow{\mathbf{Deb}\underline{ydration}} & \mathbf{chgCH_2CH} & \mathbf{Chg} \\ \mathbf{Sutanone} & \mathbf{seud} & & \mathbf{Sutanon} & \mathbf{Sutanon} & \mathbf{Sutanone} & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} \\ \mathbf{Sutanone} & & \mathbf{Sutanone} & \mathbf$$

- Q.13. Arrange the following compounds in morensing order of their property as indicated t
 - i) Acetaldehydo, Acetono, Di-tert-butyl ketono, Methyl tert butyl ketono creactivity towards HCN)
 - (ii) CH,CH,CH(Br)COOH, CB,CH Br)CH,COOH, CH, CHCOOH, CH,CH,COOH acid strength:
- iii) Benzoic acid, 4-Nitrobenzaio acid, 8,4 Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)

 Ans. The reactivity towards H. Ninddthan decreases as a effect of a my group or groups increases and for the steams.

hindrance to the nucleophilic attack by CN at the carbonyl carbon increases.

Thus, the increasing order of reactivity is

. We know that +I effect decreases the and strength of carbonyho and while. I effect unreases the and strength of carbonyho and. The +I effect of appropyl group is some than that of n-propyl group, therefore, CH₀CHCOOH as a weaker acid then. CH₀CH₀CH₀CH₁.

Since I effect decreases with distance therefore. "H_NH_CH(Br)COOH is a stronger and than CH,CH(Br)CH_COOH. Thus, the overall increasing order of and strength is

Electron doubling groups decrease the reid strength and therefore 4-methoxy benzoic acid is a weaker and han acuzou acid.

Since electron withdrawing groups increase the and strength threfore, both 4-mitrobenzoic and and 3.4-dimitrobenzoic and are stronger under their hencoic and. Further because of the presence of additional NO, group at apposition with $\frac{1}{2}$ Higgsup, a.4-dimitrobenzoic and is a little stronger and has 4-mitrobenzoic and Thus he increasing order of and strength is

4-methody begzore and < benzore and < 4-methody benzore and < 8-4-dimitrobenzore and

Q.18 Give simple chemical tests to distinguish between the following pairs of compounds:

- (i) Propagal and propagone
- (iii) Phenol and Benzuic neid
- (ii) Arotophenone and Benzophenone
 iii) Benzoic acid and Ethyl benzonte
- (i) Pentan-2-one-and pentan-3-one-
- (oi) Demail: deligite and Acetophenone

(mi) Ethonal and proposal

Ans. (i Propagal and propagone

.c Propensi gives silver ourser with Tolleo's reagent

Propanone does not give this test

ALDENYDES, KEYONES AND CARBOXYLIC ACIDS

b Propensi gives red ppt with Pehling solution, while propenone does not give this test

- a Azetophenone and Benzophenone
- a Acetophenone gives yellow ppt with alkaline solution of induse indofurm issue. Becauphenone does not give this test

Phenol and Benzuic neid

a Benzoic and reacts with NaHCO, to give effervescence due to the evolution of CO,

Phenol does not give effervescence

- 5. Phenot gives violet colour with FeCt, solution but bensoir and does not give such colour.
- (to Benzoic acid and ethyl benzoate
- a. When treated with NaHCO, solution, beazone and gives brisk effervescence while sthyl beazonts does not

5 Ethyl benzoace on boiling with covess of NaOH gives othyl absolut which on heating with todays gives yellow ppt of adoroms.

- (a) Pentan-2-one and pentan-8-one
- a Perten-2-one forms yellow ppt with alknown of lodge godoform test, but penten-3-one does not give adularm test.

b. Peman-2-one gives white ppt with sodour, biguiphite white panian-3-one does not give.

- (vi) Benzaldebyde and Acetophenone
- a Benzaldebyde forms alver amour with ammonines, aliver others solution. Tollen's reagents. Acetophenous does not react.

b Acetophenone forms yettow ppt of todoform with alkaline solution of todane todoform test. Benzaidehyde does not react

mi Ethanal and proposal

Ethanol gives yellow upt of idodoform with an alkaline colution of iodine idodoform test

$$\label{eq:chochi} \mathrm{CH_{2}CH_{2}CHO} \xrightarrow{\ I_{\mathrm{li}}\ \mathrm{NgOH} \ } \mathrm{No}\ \mathrm{pellow}\ \mathrm{ppt.}\ \mathrm{of}\ \mathrm{CHI}_{\mathrm{s}}$$

- Q.14. How will you prepare the following compounds from benzene? You may use any morganic reagent and any organic reagent having not more than one carbon atom.
 - ii Methyl benzonte ii m Nitrobenzoic neid (iii) p Nitrobenzoic neid
 - te) Phenylanetis acid (e) μ-Nitrobenzaldehyde

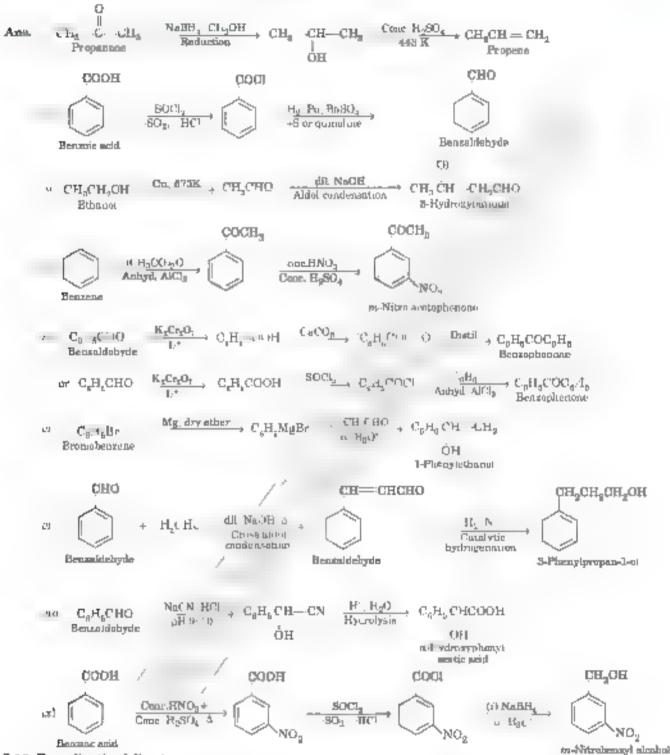
Q.15. How will you bring about the following conversions in not more than two steps ?

p-Natrobenonldabyda

- (ii) Propanone to propene
- (iii) Ethanol to 8-Hydroxybutanal
- (ii) Benzaldehyde to Benzophenone
- (ii) Benzoic arid to Benzuldebyde
- (c) Bewene to m-Natroocetophenone
- ci) Bromobenzene to 1 Phenylethanol



(en) Benzaldehyde to 3-Phenylpropan I-ol. (eiii) Benzaldehyde to c-hydroxyphenylacetic and (ix) Benzoic soid to m-Nitrobenzyl alcohol.



Q.10. Describe the following .

Acetylation ii Cannizzaro reaction (iii Cross aldel condensation iii) Decarboxylation

Ans. (i) Anetylation

The representation as active hydrogen of accobals phenols or annues with acetyl group to form corresponding enters or smalles in called acetylation. It is corried out by using end channels or anhydrodes in the presence of a base such as pyridine, dimethyl aniline, etc. For example,

Canaizzaro's reaction.

Aidebydes which do not contain any o-hydrogen stom e.g. benzaidebyde formaldebyde undergo self oxidation and reduction reaction or been ment with contradiction of caustic alkay. In this reaction, one materials is oxidised to and white another molecule is reduced to nicohol.

με) Cross aidol condensation

The condensation of two different molecules of aidebydes or ketones is called cross slike condensation. It is useful synthetic reaction only if one of the aidebydes does not contain o-nydrogen atoms, i.e., formaidebyde, bearandebyde, etc.

(a) Decarboxylation

The process of removal of a molecule of $0 \le 5$ mm a carboxyla and is caused decarboxylation. It is usually carried out by bonting a maximum of a carboxyla and or its sodium salt with sodia limit. Not 0 + 1 as

Q.17 Complete cosh synthesis by giving missing starting material, rengent or products

Cyclotiezanoi

Cyclohettanone

(i)NaIIH d

Only attushydes are outdised by Tollen's reagent

$$(E) \qquad \qquad (f) \stackrel{(f)}{\boxtimes} O_{\mathbb{R}} \qquad 2 \qquad (f) \stackrel{(f)}{\boxtimes} O_{\mathbb{R}} \qquad (f) \stackrel{($$

- Q.18. Give plausible explanation for each of the following
 - Cyclobezanone forms oyanohydrin in good yield but 1,1,6-trimethylcyclohesanone does not.
 - (ii) There are two -NH, groups in semicarbaside, However, only one is involved in the formation of semicarbasones.
 - iii) During the preparation of esters from a carboxylic acid and an alcohol in the presence of an acid catalyst, the water or the ester should be removed as soon as it is formed.
- Ans. ,i) Cyclohexanone forms cyanohydrin in good yield.

However 12,6-trumethyloydobexamone does not give eyanohydma ac

2,3.0-immediyleydoliesanone

This is because of the presence of three methyl groups at exposition with respect to carbony, group which hinder the audientiand attack of CN group due to steril anadomics. However, where is no such steric anadomics is cyclotic anomal and therefore, the nucleophilic attack by CN was occurs readily to form eyenohydrin.

Semicorboards has two. NHL groups but one of pass which is directly attached to P=P is involved in resonance as shown below.

$$H_1 \stackrel{\text{OD}}{=} C \stackrel{\text{OD}}{=} NHNH_2 \longleftrightarrow H_2 \stackrel{\text{OD}}{=} C \stackrel{\text{OD}}{=} NH = NH_2 \longleftrightarrow H_2 \stackrel{\text{OD}}{=} C = NH = NH_2$$

As a result of resonance electron density on NH, group decreases and hence it does not set as a nucleophile. In contrast the rone pair of electrons on the NH group—e_established to NH is not unolved in resonance and is therefore, available for nucleophilic attack on the C=O group of the aldehydes and ketones.

44. The formation of esters from carbonytic acid and an alcohol in the presence of an acid catalyst is a reversible reaction.

Therefore to shift the equilibrium in the forward direction, the water or ester formed should be removed as fast as it is formed.

- Q.19. An organic compound contains 69.77% carbon, 11.63% hydrogen and rest oxygen. The molecular mass of the compound is 86. It does not reduce Tollens' reagen, but forms an addition compound with sodium hydrogen sulphite and give positive iodoform test. On vigorous andation it gives ethanoic and propancic acid. Write the possible structure of the compound.

 (D.5.B. 2066, Assum S.B. 2018)
- Ans. Step 1 To determine the molecular formula of the compound

$$\Re C = 69.77$$
 $\Re H = 1.483$ $\Re O = 100-69.77 + 11.65 = .48.60$

Simple storne ratio

$$C \mid H \mid 0 = \frac{69.77}{12} \cdot \frac{11.63}{1} \cdot \frac{18.6}{16}$$

= 5.88 \quad \quad 11.63 \quad 11.64
= 5 \quad 10 \quad 1

Empirical formula = $C_2H_{aa}O$

Empirical formula mass
$$= 6 \times 12 + 19 \times 1 + 1 \times 10 = 80$$

Манесская болиція шава - 80

Molecular formula - C.H.,O

Step 2 Determining the structure of the compound

Since the given compound forms addition hydrogen sulphits addition product at must be an aldehyde or a ketone. Since he compound does not reduce Tolten's reagent, therefore, it cannot be an aldehyde unit—must be a ketone. Since the compound gives todeform test, therefore, the compound must be metaly, ketone.

Since the compound on vigorous oxidation gives a mixture of etherious and and proparate said, therefore the methyl kelone is pentan-2-one as.

The given reactions are

Sodium hydrogen autphite adorano product

restriction

C) 12

Yellow cost.

Propagine actil

Sodium butanone

+ CH_aCi₂Ch₂COONs + 3NsI + 3H_a ·

Q.20. Although phenoxide ion has more number of resonating structure than carboxylate lon, earboxylle acid is a stronger acid than phenol. Why?

Ans. The phenomic can has more number of resonating curretures but carboxylic and is more stronger acid—han phenol. Since there are two electronegative exygen atoms in carboxylate on as compared to only one oxygen atom in phenote on the electron charge to the carboxylate on. Is more dispersed in comparison to phenote on Consequently carboxylate on the relatively more stable as compared to phenote on Thus the release of H too from carboxylic and it compared to phenote and therefore, it behaves as stronger acid than phenol. For details refer page 71.

Resonance bytmid of carboxylate ron

Resonance hybrid of phenoxide ion



Exemplar Problems

Ľ

Objective Questions from Eveniples Problems are govern in Competition Pile, page 160.



Why is there a large difference in the bidling points of butance and butane, ol?

Arts. Butan-, of hes higher boiling point due countermnie cular hydrogen bonding

Subjective Questions

Write a test to differentiate between pentan-2-one and pentan-3-one.

Ans. Pentan-2-one forms yellow ppt with alkaline solution of other conform test but pentan-3-one does not give induform test.

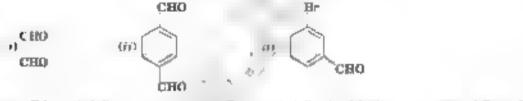


Give the IUPAC names of the following compounds

so
$$\frac{1}{C}\Pi_3\tilde{C}\Pi_2$$
, $\tilde{C}\Pi_2$, $\tilde{C}\Pi_3$, $\tilde{C}\Pi_3$, $\tilde{C}\Pi_3$, $\tilde{C}\Pi_4$, $\tilde{C}\Pi_4$, $\tilde{C}\Pi_5$

- 4. Give the structure of the following compounds.
 - (f) d-Nitropromophenume
 - (ii) 2-Hydroxycyclopentanecarbaldehyde
 - oii) Phenyl neetaldehyde

5. Write IUPAC names of the following structures.

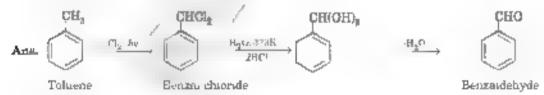


Acce. Ethene 1 2-disc

Benzene-1 4-dicarbardehyde

3-Bromobenzaidehyde

 Benzaldehyde can be obtained from benzal chloride. Write reactions for obtaining benzalchloride and then benzaldehyde from it.



7 Name the electrophile produced in the reaction of benzene with benzoyl chloride in the presence of anhydrous AICL. Name the reaction also.

Ans. C.H.CO Bensoylium carbocatous

$$C_0H_0C_1 - C_1 + AlOI_1 \rightarrow C_0H_0 - C_1 - AlOI_1 \rightarrow C_0H_0C_1 + C_0H_0C_2 + AlOI_1$$

Friedel-Oraft's acyletion reaction.

 Oxidation of ketones involves carbon-carbon bond sleavage. Name the products formed on oxidation of 2, 5-dimethylhexan-3-one.

- 2. 5-Dimetaylbexane-3-one
- 3-Methylpropenote end (Major)
- 8-Methylbutaume acid
- Рюражине

D → HCOCH

CH,COOH Ethenoir acid

- P. Arrange the following in decreasing order of their acidic strength and give reason for your answer. CH_CH_OH, CH_COOH, CICH_COOH, FCH_COOH, C_H_CH_COOH
- Ans. FCH,COOH > ClCH,COOH > C,H,CH,COOH > CH,CO,H > CH,CH,OH
 - What product will be formed on reaction of propanal with 2-mathylpropanal in the presence of NaOH? What
 products will be formed? Write the name of the reaction also.
- Ans. It is cross aidol-condensation reaction.

Propanel 2-Methylpropanal

- 11. Compound 'A' was prepared by oxidation of compound 'B' with alkaline KMnO_i. Compound 'A' on reduction with lithium aluminium hydride gets converted back to compound B' When compound A is heated with compound B in the presence of H₂SO₄ it produces truly smell of compound C to which family the compounds 'A'. 'B' and 'C' belong to?
- Ana, A is earboxylic seed
 - Bus an ethanol
 - Challen eater
 - 12. Arrange the following in decreasing order of their acidir strength. Give explanation for the arrangement. C_H_COOH, FCH_COOH, NO_CH_COOH
- And No, CH, COOH > PCH, COOH > C, H, COOH
 - This is due to electron withdrawing affect.
- 18. Alkenes $(C = C\zeta)$ and corbonyl compounds (C = C), both contain a π bond but alkenes show electrophilic addition reactions whereas carbonyl compounds show nucleophilic addition reactions. Explain.
- Ans. arbony-group is polar in an iro like to larger electronegativity of oxygen as compared to carbon carbon acquires partial positive charge while O orquires partial negative charge.

Because of slight positive charge on C auro, it is attacked by nucleophties and therefore undergoes ancheophtic addition reaction

Ethylenic double bund as a non-polar bond and as a source of electrons. Therefore, it is attacked by electrophiles and undergoes electrophiles addition reactions.

- 14. Carbovylic acids contain carbonyl group but do not show the nucleophilic addition reaction like aldebydes or lectures. Why
- Arts. Carboxyla, and do not give the characteristic reactions of carbonyl group [C=0] as given by aldehydes and ketones. In carboxyle ands, the carbonyl group is involved in resonance, as follows:

Therefore, it is not a free group. But no resonance is consible in aidehydes and ketones. They give the characteristic reactions of the group.

16. Identify the compounds A, H and C in the following resotion.

18. Why are carboxylio acids more acidio than alcohols or phenols although all of them have hydrogen atom attached to a oxygen atom (—O—H)?

Area. The alipholic carboxylic ands are stronger ands, but alrohols and abends. The difference in the relative ands strengths can be understood if we compare the resonance hybrids of carboxylate (a) and ethicide phenomiae (a).

The resonance hybrids may be represented as

The electron charge on the carboxylete ion is more that are nonparison to the phenote ion same there are two electron charges atoms of carboxylete ion as summer the only one oxygen atom of the number ion. In other words, the carboxylete ion a relatively more stable as compared to phenote ion. Thus, he retease of Hunn from carboxylet acid is comparatively easier or A behaves as a stronger acid than phenol

17 Complete the following reaction sequence

$$CH_{1} \xrightarrow{C} CH_{2} \xrightarrow{(CH_{2}M_{2}Br_{2})} CH_{3} \xrightarrow{(B)} CH_{2} \xrightarrow{(B)} CH_{3} \xrightarrow{(B)} CH_{3} \xrightarrow{(B)} CH_{3} \xrightarrow{(CH_{2}M_{2}Br_{2})} CH_{4} \xrightarrow{(CH_{3}M_{2}Br_{2})} CH_{4} \xrightarrow{(CH_{3}M_{2}Br_{2})} CH_{4} \xrightarrow{(CH_{3}M_{3}M_{2}Br_{2})} CH_{4} \xrightarrow{(CH_{3}M_{3}M_{3}Br_{2})} CH_{4} \xrightarrow{(CH_{3}M_{3}M_{3}Br_{3})} CH_{4} \xrightarrow{(CH_{3}M_{3}Br_{3})} CH_{4}$$

18. Ethylbenzene is generally prepared by acetylation of beazene followed by reduction and not by direct alkylation. Think of a possible reason.

Ana. Ethyl benzene is prepared as

$$+ CH_{2}COC1 \xrightarrow{AlCL_{2}} COCH_{3} CH_{2}CH_{3}$$

$$+ CH_{2}COC1 \xrightarrow{AlCL_{2}} COCH_{3} CH_{2}CH_{3}$$

$$+ CH_{2}COC1 \xrightarrow{AlCL_{2}} CH_{2}CH_{3}$$

$$+ CH_{2}COC1 \xrightarrow{AlCL_{2}} COCH_{3} CH_{2}CH_{3}$$

$$+ CH_{2}COC1 \xrightarrow{AlCL_{2}} CH_{2}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}CH_{3}$$

$$+ CH_{2}CH_{3}C$$

The direct alkylation does not give pure product

19. Can Getterman-Koch reaction be considered similar to Friedel Craft's acylation? Discuss.

Ans. In Gattermann both reaction, benzeue is converted to benzeudehyde by passing a mixture of CO and HCl gas in the presence of anhydrous AlCl, and traces of Cu_Cl_

This reaction is a modification of Friedel-Craft's reaction in which -- CHO group is introduced in the cenzene ring.





MEMORY TEST



A Say True or Felso

- Aidebydes and betones resot with electrophiles but not with nucleophiles
- 2. Welff Kielmer reduction of acetophenone gives toluene.
- Acetaldehyda can be prepared by the distrilation of concurrence ate.
- Acetaidehyde can be reduced to ethene in the presence of LiA.H.
- 5. Beuzuideliyde cannot undergo Cannizzaro resctum.
- 6. Aldehydes are less easily omdused than ketones.
- 7. Aestaldeliyde eyanohydrin on hydrolysis gives isotic and.
- 8. Benzaideliyde reduces Fehling solumon
- Beszaidebyde forms add.tion product with sodium baulphite but acetophenone does not
- Ketones give nucleophilic addition reartions more readily time aldebytee.
- Calcium formate on heating gives acetaldohyde.
- 19. The ρK_k value of formic and is smaller than that of aretic acid
- The earbox-usygen bond lengths in fernic sold are equal.
- Nitration of benzoic acid gives m-nutrobsuzuic and.
- During the reaction of carboxylic and with NeHCO_p the carbon of the CO_p produced comes from NeHCO_p
- When bentoic and is heated with gode time, benzene as formed
- 17. Acetate son as a stronger end than methoxide son.
- 18. Ethanour acid liberates hydrogen with sodium metal.
- 19. Me, CCH, COOH is more serdic than Me, SiCH, COOH.
- 20. Formic send gives silver mirror test with Tollen's reagent.

R. Complete the missing links

- L. Aldehydes for mired precipitate with Felding solution of
- In carbonyl compounds the carbon atom involves hybridisation
- 8. The IUPAC name of protounlidehyde is
- 4. The oxidation of toluene with gives benzildebyde
- Ketones on reduction with amalgam and water form principle

- Three moles of scatone on reflaxing with conc H_iSO_i give
- 7. Acetone reacts with hydroxylamine to form
- 8. 2-Pentanone can be distinguished from 3-pentanone by
- 2. Ammonta resets with to give protropine
- When but-2-yes is hydrated with conc. H₂SO₄ in the presence of HgSO₂, it gives
- 11. CH,CHO+HCHO di. NaOH +
- DE CHICOUH, MINNEY BOIL + HIO
- 13. C.H.COCH, + H Zo/Hg. HCl → + H.O
- 14 (CH, CO + NaHSO, -
- 15. "H,CHO + CH,CHO II di NaOR
- Carboxylic ands may be prepared by reacting Griguard reagents with
- Kolba's electrolysis of potassium successate gives earbon dioxide and
- 18. is produced on heating ammunium acetate.
- Hydrolysis of HCN gives.
- The lowest molecular mass monocarboxylic acid containing a secondary carbon acord is
- Trimethylacetic acid has pK, value than withoroscetic acid.
- 22. Ethyl acetate is reduced with LiAlH, to give
- 114. Propyl benzoic seid en azidation gives

25. Eggr₂0₇, gr

CHyCH's

Choose the correct ofternative

 When calcium acetate is distribed with cultium formate, the product obtained is acctone; acetaldehyde.

- Benzoyl chloride on reduction with hydrogen in the presence of Pd and BoSO, gives acstophenone! benzaudeliyde
- The boding point of propanage is higher-tower than that of propagal
- 4. Aldebydes and kelimes undergo micleophilic electrophilic addition reactions
- Acetaldehyde reacts with DNP to give orange/black ргенцивање
- Aldehydes and ketones react with ammonia derivatives in weakly acidal strongly acidic medium
- 7. The red brown preripitate of aldehydes with Fehling solution is due to formation of Cu_O/CuO
- lodoform test is given by ethanal/propana.
- Aldebydes or ketones are reduced to aikanos/atcahols with NaBH,
- On cooling acataldebyde with a few drops of conc. H.SO, at 0°C, the product formed is parnitishyde; metalitehyde.

- 11, The reaction CH, CH, + CO + H,O (steam) $H_{ij}P(t_{ij}, A) \rightarrow CH_{ij}CH_{ij}COOH$ is known as Koch reaction (Mendula renetion
- During the reaction of carboxylic acid with Na,CO_x the carbon diazula avalved comes from Na_CO_tearburyitt
- pK, value of m-hydroxybensoic acid is less/more than that of beuzoic acid
- 14. Carboxylic acids are reduced to alkanes alcohols with HIL red P
- 16. When calcium scatate is distined, it gives occione acetatdehyde
- 16. Former and gross, does not gross alver mirror with Tollen's rengent.
- Carboxyl group in beasons acid as n-and prim director.
- a-hydroxy benzase acad is loss I more acadic than p-hydroxy. banzore enid
- 19. Bothing points of eurboxylic needs are less / more than the corresponding ascobola-
- 20. Chloroscetic and reacts with KCN followed by acidic hydrolysie to give motoric acid tactic acid-





MEMORY TEST



Ray Tress ast Falsis

- L. Faine. A dehydes and ketones react with both mucleophiles thoses and electrophiles acids
- False. It firms ethyl benzene.
- 3. False. Distribution of calcium scetate gives acetone.
- 4. False, Ethyl alcohol is formed, 5. False.
- 6. False
- False
- 9. True 10. False
- 11 Fause. It gives formaldehyde
- True
- 18. Frise
- 14. True

- 15. True
- 16. True
- Folce: Acetate ion is a weaker bose tuon methoxide ion. because a stronger acid has a weaker conjugate base
- 16. True
- 19. True
- 20. True

B. Complete the write lightening

Sel.

- 2. sp'
- 8. But-2-eng.
- chromyl chloride in CS,
- 5. meurineium
- 6. mentylene
- aceterims (CH, CH = NOH)
- Todafarus teet.
- 9. furnialdebyde
- .C. butrus-9-one
- 11 HO—CH_CH_CHC

- 12. CH_CH_CH_
- carbon dioxide
- Acetamide
- 20. 2 Methyl propanoir acid 21. Ingher
- 22. ethyl aicebol

34 benzoe end

- - 23. 3-sulphobenzou and COOH

1a. C.H.CH.CH.

ethylene

19. formue acid

15. C,H,CH—CH—CHO

- CHOH
- Chapse the current alternative
- aceta)debyde
- 2. benzaldebyde 8. higher
- nucleophiae
- orange
- 6. weakly acidic

- 7. Cu,O
- 8. ethenel
- 9. nicohole

- metaldehyde
- 14. alkanas
- Koch reaction 12. Na,CO. 15. acetone
- 18. mes

- 17. m-
- **18.** mare

- 16. gives 19. more
- 20. melonie reid



Higher Order Thinking Skills



QUESTIONS WITH ANSWERS

Q.1. Bydrazones of acetaldehyde are not prepared in highly acidio medium. Explain.

Ans. In weakly acute medium, the carbonyl group is protomated. As a result of presence of two charge on carbon, the protomated carbonyl group undergoes nucleaphilic manch of aydranine enaily

$$C=0+H$$
, $C=0H \longleftrightarrow C_*$ OH

In strongly scalar mechanic the hydroxine being basic in nature forms its sait by protonating the unshared pair of electrons on N atom.

H.N NH. H,NNH,

This salt cannot act as nucleophile. Thus, to carry out these reactions, we have to untrol the pH between S and 4.

Q.2. Oximes are more acidic than hydroxylamine. Explain.

Ana. Oximes one a proton to form a conjugate base which is stabilized by resonance.

On the other hand, conjugate base of hydroxylanine is not resonance stabilized.

QA. Di-tert-butythetone does not give precipitate with NaHSO, whereas acctang does. Explain.

Ans. Aretone reacts with NaHSO, to give crystaline conductor addition product

$$CH_8$$
 $C=0 + N_8HSO_8 \longrightarrow CH_8$ CH_8 $COSN_8$

But distert-outly, ketone does not give a precipitate accuracy of steams hindrance by budy cert-budy groups. Bisulphite and cannot approach the carbon of the carbonyl group for addition.

Q.t. Explain why dialkyl cadmium is considered superior to Griguard reagent for the preparation of a ketone from an acid chioride.

Ans. Dialky redmining is less reactive than linguard reagent because cadmining is less electropositive electronogetricity = .7 their magnetium electronogetricity = .2. Therefore dialkyl cadmining reacts with more reactive and chlorides to give ketones out donot react further with less reactive ketones so formed to give cert-alcohols. But Grignard reagents being more reactive not only react with and character but also with ketones formed to give tert-alcohols.

Q.J. What is the function of Rochelle salt in Fehling's solution ?

Ans. In alka me mech im. "\" one get precipitated as CwOH. To keep Cu^2 one σ solution in alkaline medium. Rochelle self is added. This combines with insoluble $CwOH_A$ to form a soluble complex between Cu^2 ions and carriers ion from Rochelle self) and therefore goes into the solution.



Q.6. Aldehydes usually donot form stable hydrates but obloral normally exacts as obloral hydrate. Explain.

Ans. The addition of water to aldehydes is a reversible reaction in which the equalibrium lies almost towards left

On the other hand, in charm, the presence of three electron withdrawing Clustonia increases the eve charge on the carbonyl carbon. As a result, weak nucleophiles like water readily add to the carbonyl group forming chloral hydrate and therefore, shift the equilibrium towards right.

Chloral bydrate

Q.7 Treatment of C_aH_aCHO with HCN gives a mixture of two isomers which cannot be separated even by very careful fractional distillation.

Area, "H₆ HO reacts with HPN to form two sometric bencaldebyte evanished the because an asymmetric carbon atom is introduced.

$$C_a H_a C \longrightarrow O + HCN \rightarrow C_a H_a C OH$$

Asy neneuro carbon atom

These two sensers are enactioners and therefore cannot be separated by physical methods take fractional distribution.

8. A ketage A, which undergoes haloform reaction gives compaund (B) on reduction. B on heating with cone. H,80 gives a compound (I) which forms manazonide D). B on hydrolysis in the presence of zinc dust gives only acetaldehyde Identify A, B, I and D. Write down the reactions involved.

Ans. A $^{\circ}$ H $_{c}$ Ou H $_{c}$ CH, Butan-2-one. B CH, CH $_{c}$ CH $_{c}$ CH Butan-2-of and C $_{c}$ CH $_{c}$ CH = CHCH $_{c}$ But-2-ene. The equations involved are

A gives baloform reaction as

B. An organic compound A C_*H_*O is remetant to exidation but forms compound $B(C_*H_*O)$ on reduction which reacts with HBr to form the bromide (\cdot) . Clorus a Grignard reagent which reacts with A to give $D^*C_*H_*O$. Give the structures of A, B, C and D and explain the reactions involved.

Ans. The compound A into resilier an aideby decreake tone. Since we exists condation it must be a ketone -e in actione. CH, COCH, The reactions are obviously are



.0. An alkene (A) on ozonolyms gives accione and an aldehyde. The aldehyde is easily oxidised to an acid (B). When B is treated with bromme in the presence of phosphorus, it yields compound (C) which on hydrolysis gives a hydroxy acid. D). This acid can also be obtained from arctone by the reaction with hydrogen cyanide followed by hydrolysis, Identify the compounds A, B, C and D.

Ans. A gives acatone and an aldehyde (RCHO)

$$CH_{a} = O + C = C - R$$

$$CH_{a} = O + C = C - R$$

$$CH_{a} = O + C = C - R$$

$$OH_{a} = OH_{a}$$

$$OH_{a} = OH_{a}$$

$$OH_{a} = OH_{a}$$

$$OH_{a} = OH_{a}$$

The nature of aideligits can be established by its product D.

D can also be obtained from B as

Thus, A is

 An organic compound A, O_βΠ₁₀O_γ on reaction with OΠ₂MgBr followed by acid treatment gives compound. B. The compound B on oxonolysis gives compound C, which in presence of a base gives 1-acety, cyclopentene. D. The compound B on reaction with HBr gives compound E. Write the structures of A, B, C, D and E. Show how D is formed from C. (LIT 2000)

Ans. The C and H ratio of A archeotes that - is a cyclic compound. The reaction of A with CH_MgBr indicates that it should have a ketonic group. The reactions are

Due formed from 🦿 by intramolarmar condensation of a direction $y^1 = y$ with a take forming a cyclic compound

.2. Identify (X) and (Y) in the following reaction sequence:

Ana.

.8. Experie the last that the C-O bond length in RCOOH is shorter than in ROH

Ans. RCOOH has the following resonance structures:

Because of the contribution of structure U. there is some double about character in the C—O bond of the and. Therefore, C—O bond length is shorter than in R—OH which has only C—O single bond.

.4. Highly branched carboxybe soids are less acidic than unbranched soids. Why?

Ans. The ranhoxylate on RCOF of branched that a substituted from solvent molecules and therefore, cannot be stabilized by solvention as effectively as the carboxylate con of unbranched ands.

48. Although p-hydroxy benzoic actd is less acidle than benzoic acid, or the hydroxy benzoic acid salicylic acid? is about 15 times more acidic than benzoic acid. Explain.

Aris. Off group is electron releasing group and therefore. Increases the negative charge of the enion. As a result, p-hydroxy benzoic and is less and/o than benzoic and. However, onlydroxy cleazoic and is more and/o than benzoic and. The entranced and/of p-isomer is due to very effective intramolecular dydrogen honding on the carboxytate con. As a result, p-hydroxy benzoite ion is stabilized to a great extent and therefore, it makes o-womer more end/o

16. Fluorine is more electronegative than oblorine but p-fluorobeazoic and is a weaker and than p-chlorobeazoic and Explain.

Ans. Helogens are more electronegative than carbon and also possess ione pairs of electrons. Therefore matogens can exert. It and + R effects in F atom, the ione pairs of electrons are present in 2p-orbitals but in \cap 1 atom, they are present in 3p-orbitals. Since 2p-orbitals of F and \cap 2 are of almost some size, therefore, + R effect is more pronounced in p-fluorobenzous and

Thus n p from the new tensor and k + R effect on weight the R effect and therefore it is weaker and thus p-chlorobenzoic and theying more R effect than R effect

17 Addition of Grignard reagents to dry see followed by hydrolysis gives carboxylic acids whereas that of organolithium compounds under similar conditions give ketones. Explain.

Ans. The electronegativity of \mathbb{Z}_{+} \mathbb{Z}_{+} \mathbb{Z}_{+} 0 is lower than that of Mg \mathbb{Z}_{+} \mathbb{Z}_{+} as that organisational compounds are more nucleophylic from Engineer reactive. Therefore, organisation compounds not only add to the more reactive. It is not not used to see that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in the more reactive in a but not used to be seen that the more reactive in a but not used to be seen that the more reactive in the more reactive in the more reactive in the more reactive.

On the other hand. Congruend reagents are less nucleophilis and add only to "V", but not an ease reactive resonance stabilized magnesium solts of carboxylic acids from which the carboxylic acid can be generated by hydrocysis who interest scula

.8. Fill in the blacks with appropriate structures of resotion products in the following transformation:

carrying I mark

Revision Exercises

Very Short America Countiers

- Arrange the following in order of their increasing reactivity aswards HCN CH_CHO CH_COCH_ HCHO CH_COCH_
- What is the hybridised state of carbonyl carbon atom?
 Komunity S.B. 2014
- Is a one chemical cert to distinguish between persan-2-me and pentan-d-one
 Assum S.B. 2013
- Sive the structure and ILPA: name of an alighetic aldehyde inving the curton manus which undergoes annuizzaro's reaction.
- 5. Write down the posttom reconer of



 What Imprens when benzophenone is reduced with ZniHg in the presence of HC1?

- Draw the structure, formula of 1 phenylpropen 1-one D 5.B 2000
- Complete the following reaching

- 2. Arrange the following compounds in an increasing order of their reactivity in nucleophilic addition reactions ethanal, propanal, propanone, butanone. (D.S.B. 2012,
- 10. Arrange the following in the increasing order of their reactivity in nucleophilic addition reactions. C.H.CHO, G.H.COCH, C.H.COC, H. Meghalayo S.B. 9015 11. Write the IUPAC name of

Mezoram S.B. 2015

ĊH

12. Write the JUPAC name of ICH, / CHCHO

(Nagoland S.B. R018

- 18. Write RJPAC name of (Hr S.B 2018)
- 14, What is Tollen's reagent? Ph. S.B. 9018
- 15. Write the IUPAC name of the compound CH_CH_CH_CH_CHO NH. (D.S.R. #014)
- 16. Write the IUFAO name of the compound

(D.S.B 9014)

17. Arrange the following in the increasing order of boiling

ен, ен, ен,соси ед и

- 18. Give one test to distinguish between phenol and bearons Hr S.B 96:0
- 19. Arrange the following in the order of increasing acidic

си,сивсоон 🗼 си,си,соон (m CH,CF,COOH

- 20. Among C.H.COOH and CH.CH.COOH which is stronger acad and why? tHr S.B. 2018
- Gave the HUPAC name of HOOCCH = CHCOOH
- 23. Arrange the following in the decreasing order of dipole monten. еңсио гендеолеңсион
- 28. Identify A and B

MI, NOOH NH, A P,OL (Assum B.D. 2010)

- 14. Give chemisted certa to diabing until between formic and and mestic acid. Ph.S.B 2018
- 26. Write the IUPAC name of

Manipur S.B. 2014).

26. Write the ILPAC name of the compound

ōН

COOH COOR 27 Among вец1 which is stronger and and why? Maghalaya S.B. 2010)

38. Write the IIPAC name of CH, CH CH, CHO-

(Nagaiand S.B. 2015)

- Give the IUPAC name of the following compound: CH_= CH CH, CHO : / Assem S.B. 2018
- 30. Complete the following reaction

(H P S.B. 2015)

(D.S.B. 2014)

81 Complete the following reaction

CH, YOUI+H, Pd Baro,

CH P S.B 2015)

 Arrange the following in the increasing order of pK_values. съдоон сиси, соон, сденсоон сдесоон Assom & B 2070-

CBSE QUESTIONS -



30. Write the 1 PAs name of H, 4 H, 4 K H. A . S B. 2000

84. Write the structure of 8-isopentanal. A.I.S.B 2009 Write the structural formula of I-puerlyber-ten-z-one .A.1.S.B 2000

Write the IUPAC name of CH, CH—CO—CH—CH.

A.I.S.B. 2010

37 Write the L. PA. name of the following.

ALSE WILL

- Ethanal is soluble in water Explain. A.I S.B 2010
- Write the structure of p-methylbenzaldehyde. ALSB. Total

 Write the structure of 4-chloropenson-2-one. (A.1.S B. 2014

 Write the structure of 2-hydroxybenzine and. A.I.S.B. 2014

ADDITIONAL QUESTIONS OF 1 MARK

43. The RIPAC name of the compound

/a. 2-Oxo-but-S-enal

- /b, 3-Oxo-1-formy/pent-4-are smd
- Formylpent-4-en-3-one
- id 5-Ozopentanoic acid

Mazorani S.B. 20171

ALDENYDES, KEYONES AND CARBOXYLIC ACIDS

43. Which is most ecidic?

(a) CF,COOH b) CC1,COOH

el CBr,COOH

a CH TOOK

Hr.S.B. 2013

44. Among the following which has lowest μK, value?

(а НСООН (б) СН,СООН

(c) (CH,),-CH-COOH d) CH,-CH,-COOH

U. CD DOL

Hr S.B 2014

45. The RUPAC name of CH₂CH₃—C—CH₄—C—H t

а, 1-окоревьяны-В-опе

I-osopentanci

(c) 8-ozopeniana)

(d. S-exapentana)-S-one

Mixoram S.B. 2015

45. What is the name of the following reaction

For Stephen reaction

(b. Rosenmund reduction

(c) Retard reaction.

(d. Aldel condensation

Hr S.B 2015

47. CH, COCI $\xrightarrow{\text{Pd}_1 \text{H}_2}$ X, X in

(a) acetaldehyde

(b. neetone

(c) etby) chloride

(d forms and (Hr.S B. 2015).

48. Addition of HCN to a crubonyl compound is an example of

(a) nucleophilic substitution reaction

& nucleophate addition reaction

(c) electrophilic addition reaction.

(d. electrophilic substitution reaction

Meghalaya S.B. 2017

49. Strongest ecid is

(a) p-ClC,H,COOH

ъ №0)-(С.И СООН

(e) C_H_COOH

@_p-NO_C_H_COOH

Hr 8.B 2018.

50. Strongest ocid is

ia/ CH,COOH

CH, CHCICOOH

с СН Н,(3,л Н

ra CH, MCH, CH, COOR

Hr E.B. 2016.

51. Which on heating with equeous (COH, produces acetridehyde?

(a) CH, -CH--Cl, \ (b) CH,--CO--Cl

(c) CH,--CH,--CL

(d, CH,-CI-CH, -CI

Hr 8.8 2017

(Hr S.B. 2017

59. Indoferm tost is not given by

(a) Pentan-2-one

(c) Ethanol

(b, Pentan-3-one

fd. Ethensi.

59. In the following, strongest and is

faz CH,CH,COOH

th CH,COOH

ic C_cH_cCOOH

a C.H.CH,COOH

Wr S.B. 2018.

64. In the following reaction product P is

$$HC3$$
, $H_2C \rightarrow P_1$
 CHO
 CH_1
 $CH_2C \rightarrow P_2$
 CHO
 $CH_2C \rightarrow P_3$
 CHO
 CHO
 $CH_3C \rightarrow P_4$
 CHO
 CHO
 CHO
 CHO
 CHO
 CHO
 CHO
 CHO
 CHO

55. Acetaldebyde and azetone can be distinguished by

(a) FeCl, test

/ (b) No.HCO, test

fc. Tolleans test.

(d. Mohach test

Majoran S B 2018:

>> Stockflowitz-Quantiers

carrying Sor 3 marks



How does C = O differ from C = C group in chamical repetions ²

2. Explain the following

- It is necessary to control the pH during the reaction of aldehydes or ketones with animonia derivatives
- b Benzophenone does not react with addition histolphits.
- ¿ Acetaidehyde gives aidoi condensation while formaldehyde does not
- 400 HCHO reacts with HCN feater than CH,CHO
- Aldehydes and ketones undergo nucleophilic addition reactions.
- to Explain the mechanism of addition of Grignard's reagent to the carbonyl group of a compound forming on addited followed by hydrolysis. (D.S.B. 2009)
 - Bustrate the following named reaction by giving examples
 - c) Cannizzaro's reaction.
 - (a) Clemmensen reduction
 - .D.S.B. 2009, 2017
- 4. (a. Why is tr-hydrogen in carbonyl compounds acidic?
 - .b) How can you distinguish between acatophenone and benzaidehyde? Meglintoya S B 2013

5. How will you bring about the following transformations?

- Acetic acid into acetone.
- u Acetaldehyde into lactic acid
- ... Acetone to rodoform
- ar) Propassone to propene
- Benzose sord to m-mitrobenzyl steobol

Or

Distinguish between the following pairs.

Propanal and propanone

n Phenol and beazon and Jharkhand S.B. 2018:

6. An organic compound P(C₂H₄O) reduces Tollen's reagent. On condition of P with scadified K,Cr₂O₅, the compound A se formed which on treatment with calcium hydroxide forms a compound B. Dry distillation of B produces C which in warming with dulute NaOH gives D. Heating D with an and produces E. What are A, B, C. D and E and give the reaction sequences.

(Manaper S.B. 2014)

- a Give a chemical text with equation to distinguish between methanic and ethanic
 - .b) An organic compound has the molecular formula C₁H₁₀O. The compound does not reduce Tollen's reagent, but reacts with Brady's reagent to give orange precipitate. On vigorous oxidemon, the molecule produces ethanors and and propanors and. The compound also gives indoform test Identify the compound and write equations for chemical reactions avolved.
 - What happens when carbonyl compound is tracted with zinc smalgers and concentrated hydrochloric and? Give chemical equation. What is the name of he reaction? Assum S.B. 2016.
- 8. a What are Classen-Schmidt condensation and Kuthe's reaction⁹ Give one example of each.
 - b NH₂ and its derivatives do not show nucleophilic addition reactions with antehydes and tetrines in high arithmetican sustify Ph S B 2018.
- Write chemical reactions to affect the following transformations
 - i) Butan-1-ol to butanoic seed
 - cii) Benzyl alcohol to phenyl ethanoic acid
 - to: Benzamide to benzoir acid

D.S.B. 201.

- (a) How will you convert beazure and to beazaidebyde?
 - (b) How will you convert beazons and to ethyl beazonte?
 - (c) Write a short note on H.V Z. reaction

HPS.B. 2012

- 11 (a) Boiling points of corboxybe acids are higher than the corresponding alrohots. Explain.
 - b Identify compounds A. to (D) in the following reactions.

$$CH_{3}CH-C(CH_{3/2})\underset{\mathcal{H}_{3}}{\longrightarrow}H_{3}\overset{\mathcal{H}_{3}}{\vee}ZS \xrightarrow{A} A \xrightarrow{B} B$$

$$(42) C_{3}H_{3}CDOH+BOCL_{3} \xrightarrow{A}(C) \xrightarrow{PA/BaSO/B}H_{3} \xrightarrow{A}(D)$$

Meghaloyo 8.B. 2015

- 12 c What are Etard reaction and Gattermann Korh reaction? Give one example of each.
 - Aldehydes are more reactive towards nucleophilic addition reactions than ketones, Justify

19. Name the rengence used in the following reactions:

$$CH_i \rightarrow C \leftarrow CH$$
 $\xrightarrow{7} \rightarrow H \rightarrow H \rightarrow H,$ $C_iH_i \rightarrow CH$ $\xrightarrow{7} \rightarrow C_iH_i \rightarrow COOCK$ $\xrightarrow{1} SB2015$

14. Predict the products of the following reactions.

CH,
$$C = 0$$
 $\xrightarrow{(i: H_2N - NH_2)}$?

CH₃

CH₄
 $C_3H_4 = CO$ $CH_4 \xrightarrow{NaOH/L_3}$? +?

Get, $C_3H_4 = CO$ $CH_4 \xrightarrow{NaOH/CaO}$? DSB 2015

- 15. Write short notes on the following
 - fall Cannizzaro's reaction
 - To Rosenmand reduction

(c. Friedel Crafts acylation

Or

Give chemical tests to distinguish between the following pure

- (a, Beazorc and and ethyl cenzoate
- (b) Fentan-2- one and pentan 3-one
- (e/ Benzaldelyde and acetophenone

HPS-B 2018

- 16. Write short notes on the following:
 - (a. Aidol condensation
 - (b) Clemmensen reduction
 - (c/ HVZ reaction

640

Give chemical tests to distinguish between the following pairs of compounds

- (c, Ethanal and propaus.
- (b) Phenol and benzar acid
- (c. Acetophenone and benzophenone (R P.S.B.2018)
- 17 (à Gye chemical reactions for conversion of bromobenzene ato benzaire stric.
 - 5 Explain the following reactions with example 7 Aldol condensation reaction (a) Hell Volhard Zemaky reaction. (Hr S.R.2015)
- 16. a Complete the following

C,H, CHO HCN → A H', B₂O → B

- Aldehydes are more reactive than ketonas towards a releophilic reactions Explain.
- (c) Complete the following

19. /c What is formalm?

Pb.S.B. 9015

(b) Complete the following reaction.

- 20. 'c Why is the bond length of C=O in corporyin acid is alignaly larger than that in aldehyde and ketime?
 - 65 Complete the following reaction.

$$C_bH_bBr + Mg$$
 ether $\Rightarrow 9$ $\frac{CO_b}{H_bO^*} \Rightarrow 9$

 Arrange the following in the order of increasing acid strength

H.P.S.B. 2016)

21 /cz. How will you distinguish between

CH₂CHO and CH₂CCH₃

6 Complete the following reaction
2H 1Hy + NrCH 50% + 74.7

 Arrange the following in decreasing order of scidic strength

H,O. CH,OH, C,H,OH, CH,COOH JH.P.S.B. 2016.

- 22. (a) Why are the boiling points of carboxylic scids higher than those of the corresponding alcohols?
 - (b) Define the following terms and write the reaction involved in it
 - (. Remier-Tiemann reaction
 - ii Rosennumd's reduction reaction

(Nagarand S.B. 2018.

- 25. Describe the following:
 - (a) Wolf Kishner reduction
 - (b) Clemmensen reduction
 - (c) Cross nidol condensation

O

Convert benzene into

- a. Benzaldeliyde
- Benzou and

*c Acetophenone Hr S B. 2010-

- (a) What is ald al-condensation reaction? Write the reaction involved in it.
 - (b) What happens when
 - (r) Aidehyde reacts with hydroxylamine.
 - is Ketone reacts with bydrazine

Nagarand S.B. 2018.

- 25. (a) Why is formaldebyde more reactive than acatone?
 - (b) Complete the following.

(t) C.H.COOH + NH, .u, C.H.COOH + NAOH

 H_{\bullet} C, H_{\bullet} COOH + NaOH \rightarrow (Pb.S.B. 2010)

- 20. Oil Why mie aidebydes more reactive than keimies?
- (b) Complete the following.

(r) RCOOH + SOCI,

⇒ PCH,COOH + 2Na → Pb S B Royce

27. (a) (b) What happens when acatone reacts with HUN'

- 2. The melting point of butsnot acid (C₂H₂COOH) is higher than pentanon acid (C₂H₂COOH). Explain.
 Or
- (b) (a) What is cross-addol condensation reaction? Give an example
 - a) what happens when ocetaldebyde reacts with a Hydrazine b) Phenyl hydroxine

Nagauand S.B. 2016.

- 28. Write short notes on the following.
 - 7a. Reimer-Tiemann reaction. HPS-8 2018
 - (b) Etard reaction.
 - (c) Camazzaro reaction H P.S.B. 2018, Hr S.B. 2018
 - for How will you convert methers, into ethens!
 - (b) How will you convert benzaldenyde mto benzophenune?
 - Rowwil yor convertethansi arto ethanisa mat' H P.S.B. 2017

 fa, How will you prepare aldebyde from Alcohol (a. BCOO), Cs. (40) Alkyne

- (b) Why do a)dehydes undergo noeleophtic addition reactions more readily than ketones? Explicit
- (c) Why do our buzylar acute and give characteristic reactions of carbony! group? Hr B B, 2017.
- 50. Explain
 - Glemmensen's reduction
 - Nitration of benzaideliyde
 - as Give reaction of HCHO with HCN

- \$1, (a, Explain Reseamend reduction reaction with equation
 - (b) How does proponente(CH_pCOCH_p) react with hydrazine? Give equation.
 - (c) Name an analyzing agent used in the Etard's reaction. Xurnataka S.B. 2018:
- 82. Write the fullowing reactions
 - (a) Hairform reaction
 - 45. Gethermann reaction.
 - (c) Hunsdiecker's reaction
 - (d) Remor-Tleman reaction. (Pb.S B 9017
- 28. G. Write Connizzaru reaction.
 - (a) Write endol condensation.
 - (iii Why are aliphetic carboxylic acids stronger than phenols?
 - (a, Carboxylic acids do not give characteristic reactions of carbonyl group Emplain.
 - (b) Why does dehystee and ketones have high dipole moment? (Pb.S.B. 2017)
- 34, (i) Write Hell-Volhard-Zelinsky resotion.
 - 44 Write ryose aldol condensation.
 - (i.e., Ethinnoic and is weaker acid shart benzons and Why?

 Pb.S B. 2017:
- 86. (a) Write Clemmensen reduction reaction.
 - 4. Write Resemmend reaction
 - ** Formaldehyde give Cannizzaro reaction whereas acetaidehyde does not Why?

Or

- Aidebydes and keitones undergowniumber of our leophiae add three conclusion. Why?
- (b) Aceta and a liquid while aromatic ands are colds Give reasons. Ph.S.B 2017:
- 30. /a. How are aldebydes distinguished from kelomes using Tollen a and Fehling's reagent? Torrerumpleta chemical reactions.
 - 4b, A carbonyl compound with molecular weight 86, does not reduce Fehling's solution but forms crystalline bisulphite derivative and gives indoform test. The possible compounds are.
 - (a. Pentan-2-one and pentan-3-one
 - ... Pentag-2-me and 8-methylbutan-2-one
 - And Pentan-2-one and pentanal
 - fin, Pentan-3-one and 3-methylbutan-2-one

-Manupur S B. 2017)

- An organic compound X(C,H₂O), on andation, gives Y(C,H₂O₂). Compound (X) undergoes ininform reaction. On treatment with HCN, compound (X produces Z which on hydrolysis gives 2-hydropropenous and identify X, Y and Z. Write the equation for the reactions involved. What happens when X is treated with dilute No. H?

 Asson S.B. 201
- (a, 4). Why are aldebydes more reactive than ketones towards nucleophics addition reaction?
 - In Give the reaction myolved in
 - di Cannizzaro reactioni
 - Clemmensen reduction.

Or

- 4b, 4c. What is Fehling's solution test?
 - (ii) Give the reaction of Grignard reagent with aldebyde and ketone. (Nagoland S.B. 2017)

- 39. Write a short note on Roseamund's reaction giving suitable chemical reaction.
 - for Explain that the bond length of C=0 in carboxylic and is slightly larger than that in aldebydes and ketones.
 - 6. Explain why chloroacetic and is a stronger and than Micoram S.B 2017
- 40. Write structures of compounds A, B and C in each of the following reactions:

$$C_0H_0Br \xrightarrow{Mg dry uthur} A \xrightarrow{\sigma = CQ_{2g}} B \xrightarrow{PCl_0} C$$

(b)
$$CH_3CN \xrightarrow{a \text{ 9nch}_2 \text{ 1ch}} + A \xrightarrow{dat \text{ NaOH}} + B \xrightarrow{a} + C$$

Do the following conversions in out more than two steps:

- Benzoic neid to benzeldehyde
- (ii.) Ethyl benzene to benzoic acid.
- Ртирапопе со рторене.

D 5.B 2017

- 41. Write the reactions involved in the following
 - 6. Hell-Volhard Zehnsky reaction.
 - Decarboxylation reaction

(D.S.B. 2017)

- 42. Write the equations involved in the following reactions:
 - Wolff-Kahner reduction.
 - for Etard coarting

D.S.B 2017



- 167 Write was absenced equation to illustrate each of the following reartion
 - A Roseamund's reaction
 - (ii) Cannizzaro's reaction.

A I S.B. 2007

- 44. Write chemical tests to distinguish between the following page of compounds
 - 1) Aretophenone and benziphenime
 - a. Ethenal and propensi
 - " Propensi and propenone

A I S B 2008

- 46. An organic compound A contains 60.77% carbon, 11.63% hydrogen and rest oxygen. The molecular mass of the compound is 86. It does not reduce Tallan's reasont but forms an addition compound with sodium hydrogen sulphice and grees positive industries test. On vigorieus axidation it grees etheratic and propagate acids. Derive the possible structure of A. A.I S.B. 2008; D.S.B. 2008, 2009.
- 46. Give chemical tests to distinguish between following pairs of compounds
 - (i Propanal and propanoue
 - (iii Acetophenone and bencophenone
 - (iii Phenol and benzoio acid

A.I.S.B 2000

- 47. How wai you brang about the following conversions?
 - Ethanal to 5-bydynaybutana.
 - Benzaidenyde to benzophenona ALDE SUL
- 48. (a) An organic compound A has molecular formula C.H.,O., It gets hydrolysed with dil. H.SO, and gaves a carboxylia and B and an alread C. Oxidation of C with chromic acid also produced B. O on dehydration gives but 1-eas. Write equations for the reactions involved.
 - (b) Write chemical equations to illustrate Heli Volhard Zelmsky reaction. (A.I.S.B. 2009).

49. Name the reagents used in the following reactions

 CH_s —CO— CH_s 7 \Rightarrow CH_s —Q— CH_s

A.I.E.B. 2016)

Predict the products of the following reactions:

Git CH,COOH - NRara 7 (A.I.S B. 2018

- 51 How do you convert the following?
 - (a) Ethrunal to proposition
 - (b) Toluene to benzoic soid

Assume for the following

- Aromataccarboxybe and ado not undergo Priedal-Crafts
- (b) pK, value of 4-netrobenzous send as lower than that of benzale acid. (ALS.H. 2012)
- A. (B and C) are three um-cyclic functional isomers of a carbonyl compound with molecular formula C.H.O Inomers A and (C) give positive Tollen's test whereas somer B does not give Tollen's test but gives positive iodoform test somers (A. and B) on reduction with ZntHgYcone, HCl give the same product (_))
 - to, Write the structures of A., (B., 'C) and D
 - the Out of A., (B and (C momers, which one is reset reactive sowards addition of HCN? (A.I.S.B. 2018)

continuit a marks



- (a) Describe the following giving linked chemical equations (i. Cannizzaro renction in Decarboxylation.
 - b) Complete the following chemical equations:

- 2. (2. How will you bring about the following conversions?
 - i) Propagoue to propage
 - Benzoyl chloride to benzaldehyde
 - ...) Ethanai to but-2-enat
 - (b) Complete the following reactions
 - HCHO Conc ROb

ALDEHYDES, KETONES AND CARBOXY JC ACIDS

 Give simple chemical cests to distinguish between the following pure of compounds

Ethanni and Propanal

(D S.B. 2015

3. (a. Write the products of the following reactions.

- 6) Give simple chemical sests to distinguish between the following pairs of compounds:
 - (i) Benzaldebyde and Benzoir arid
 - (ii Propanal and Propanone

Or

- to Account for the following
 - c) CH₂CHO is turns resctive than CH₂COCH₂ towards reaction with HCN
- (b) Write the chemical equations to flustrate the following name reactions
 - ., Wolff-Kishner reduction
 - te: Aidol condensation
 - a: Cana szace reaction

D S.B 2014

- (a Write chemical reactions to affect the following conversions
 - 6 Butan-1-of to butaness and
 - (ii) Cyclobeasens to hearing-1, 8-their acid.
 - or Butana, to butaness acid
 - (a) Ethanoic send to ethanoic anhydride.

Assem S.B 2018

(b) Identify the products A and B in following reaction

 $HCHO \xrightarrow{enn \ KOH} A + B$

(Assem 8.B 2018)

- 5. (a) An organic compound with molecular formula C₂ H₁₀ D forms 2, 4-DNP derivative, reduces Tollen's rangent and undergoes Cannizzaro's reaction. In Agricus exidusion it gives 1, 2-benzene dicarbozytic and Identify the compound.
 - 6 How will you bring about the following conversions in our more than two steps?
 - L. Propanime to propane
 - Benzoic seid to benzeldeligde.

Meghalaya.S.B.2015.

- 5. (a) How will you bring about the following conversions
 - Toluene to benzaldebyda
 - in Ethanemarile to ethanous and
 - 70, Indentify A. B. C and D in the following reactions

$$C = \begin{cases} B_2 & \rightarrow A \\ BaSC_4 & \rightarrow A \end{cases}$$

$$C = \begin{cases} C & \text{analysis (AlCa)} \rightarrow B \end{cases}$$

$$C = \begin{cases} C & \text{Come. NaOH} \rightarrow C \rightarrow C \end{cases}$$

Assum S.B.2015

7 of Identify A. B. C and I'm the following:

th, How will you convect

(c) Write appropriate reagents for the following

- of, Distinguish between formic and and socialdehyde by a stutchle chemical test. (W.S.S.B. 2016)
- (a, Arrange the following compounds in an increasing order of their reactivity to anticophilic addition reactions ethanal, proposed, propagate, butenone
 - (b. Differentiate with chemical tests.
 - : Ethenel and Ethenole and
 - # Beneridehyde and Acetophenone
 - & Convert
 - Ethanai to 3-bydrozybutannie arid
 - μ) Ethyl benzens to henzuir and

Or

- (a. An organic compound having the molecular formula C₁H₁O₂, A₂ reacts with water. One molecule of (A) produces two molecules of an organic acid/B₂. A₃ forms and e C₁ on reaction with aminima. (B also forms the same amide compound. The compound 'C₁ forms acetometrile on reaction with P₂O₃. Identify A₂ B and C Write down the reactions.
- /b. Distinguish between the following pairs by chemical test. G_aH_aCOOH and G_aH_aOH
- /c. Which one of the following does not respond to Tollen's test?

e) Ht HO

(b) CH_CHO

.c HCOOH

.d) OH,COOH,

(Tripure S.B. 2016)

- /a. Explain why aidehydes are more reactive than ketones towards mideophilic addition reactions
 - (b) Explain with the help of chemical reactions what happens when
 - () Butan-2-one is treated with Zn/Hg and conc. HCt,
 - (a) two molecules of heazn)debyde are treated with cone Nofith;

(...) acetone is treated with semiourbezide

(c, How will you differentiate between beazons acid and phenul?

Or

- (a) Here will you bring about the following conversions?
 - Tuluene to benzaldebyde
 - Benznyl chloride to benzaldehyde
 - tte Ethanai to propan-2-ol
- Arrange the following in the increasing order of their endic strengths
 - "о сң снеск, соон сң сң сң се, соон
 - 6 Benzoic soid. 4-introbenzoic acid. 8,4-dimetrobenzoic arid, 4-methoxybenzoic acid.

·Meghalaya S.B 2010.

- Aldehydes, ketones and carboxylic acids are carboxyl compounds.
 - (a. Aldebydes differ from kerones in their midetion reactions Illustrate with one example.
 - 'b, How will you prepare benzaldebyde by Gatterman-Koch reaction?
 - fc, Write the reactions of carboxylic and with the following reagents. (Write the chemical equations)
 - .0 Through chloride (SOCL)
 - (a) Thiorine in the presence of small amount of red phosphorus
 - ut, Lathum alummium aydride (LaA.H_eVether Or
 - 60 Write a test to distinguish between midehydes and fortones
 - 7b, Haw will you prepare benzaldeliyde ay Etard's reaction?
 - fc How will you bring about the following conversions? Write the chemical equations.
 - : Ethenol → ethenole and
 - μ) Benzamide → benzoio neid
 - (si: Benzaldehyde + meta nitro benzaldehyde

Kernla S B.2016.

 Write the structures of A, B, C, D and E in the following resonants:

$$\begin{array}{c} C_{s}H, \xrightarrow{CH_{s}COCI} & A \xrightarrow{2n-\operatorname{Fig/mon-HCl}} B \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ &$$

- (a) Write the chemical equation for the reaction involved in Camazzaro reaction.
- b Draw the structure of the commerciazone of ethanat
- fc, Why in pK, of F-CH,-COOH lower than that of Cl +CH,→CN-H?
- fd. Write the product in the following reaction

- e How can you distinguish between proposal and prepancie? D.S.B. 2078
- (a) The product obtained when because is treated with carbon monoxide and hydrogen chloride in presence of antividrate AICl, is
 - Chiorobeuzene
- o Phenol
- at, Benzeldehyde
- at Benzow and

th, How will you carry out the following conversions?

Explain the following:

- (r) Esternfication
- w Tollen e test
- (ii) HVZ reaction
- to Deenrhoxylation of carboxylic acid

Kerala S.B.2017

 π Identify the products A, B, C and D from the following sequence of reactions

- b' Write a reaction to illustrate Cannizzaro reaction
- or Give a sample ghomeral test to distinguish between benzaldebyde and acetophenous
- d) Write the product of the following reaction

Meghaloya S.R. 2017)

- (i) Give a general method of preparation of aldebyde, using a selective cooling agent
 - iii Give an example of Clemmensen reduction reaction.
 - ... Identify the products A and B in the following reaction. $2HCHO + cone. KOH \stackrel{\Delta}{\longrightarrow} A + B$
 - (iv) Write complete chemical equation for the transformation of benzamide to benzoic and
 - ,v) Arrange the following in moreosing order of scidity CH_COOH, CH_CH_COOH, C_H_COOH, C_H_CH_COOH
 - by Measton one use of methanoic acid

Assum 5.B 2017

15. Write the products of the following reactions

- b Give simple oberaced tests to distinguish between the following pairs of compounds
 - ,. Benzaldehyde and benzoic and
 - a Propana, and propanone

Or

- (a) Account for the following
- (i) CH₂CHO is more reactive than CH₂COCH₂ towards reaction with HCN
- 2-Fluorobutanous and is a stronger seed than 9-fluorobutanous and.
- b Write the chemical equations to illustrate the following name reactions:
- 2 Etard reaction.
- ... Resenmental's reaction
- c live the mechanism of symposytrin formation when caronally emaporate read with HCN in the presence of sittal. CBSE Sample Paper 2011-18
- 16. (c) How would you account for the following
 - Aldehydes are more reactive than ketones towards nucleophilic addition reactions.
 - ...) Boiling prince of aldehydes are lower than alcohols.
 - .iii Addition reaction of sodium hydrogen sulphite is useful for separation and purification of aidehydes

Kerala S B. 2018

- Arometic aldehydes undergo electrophilic substitution reactions. Write the intration reaction of benealdehyde with chemical equation. Karala S B. 2018
- c Write the name of products formed when asheylic and is treated with acetic anhydride in acid medium.

Keralo S.B. 2018

- 17. (a) What type of aldebydes and ketones undergo aldoi condensation?
 - (b) Why does benzom and not undergo Fridel-Grafts reaction?
 - (c) Convert influence so 5-mitrobenzore and.
 - (d) Identify the products A, B C and D from the following reachens

e) CH₁CHO + NH₂NH₂

EOH Givel

(Meghataya S.B. 2018)

CBSE QUESTIONS



- o', Describe how the following conversions can be brought about
 - (i) Ethylbenzene to benzoic acid
 - Bromobenzene to bemain acid.
 - b) Illustrate the following name reaction.
 Hell Volhard Zehnsky reaction.
 - c) How are the following conversions carried out
 - (i) Ethyleyanide to athanne and
 - a Butan 1-o) to butanose acid
 - Methylbenzene to aenzore end

Write themical equations for the involved renotions.

A.I.S.B. 2010

- a) Give chemical tests to distinguish between the following
 - (i) Beazoic acid and ethyl beazoate
 - (ii) Benzeidebyde and acetophenose

 b) Complete each synthesis by giving missing reagents or products in the following

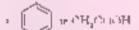
(a. C.H.CHO HACONHNE,

- 20. (c Illustrate the following name reactions
 - .r Canarzzaro's reaction
 - # Clemmensen reduction
 - b How would you obtain the following
 - But-2-sun from ethernal
 - (i) Butacone acid from butanol
 - to. Benzosc acid from ethylbenzene (A.I.S.B. 2011
- 21. (a) Give channeal tests to distanguish between
 - The Propagal and propagone
 - a. Penzaldebyde and acetyphenone
 - (b) Arrange the following compounds in an increasing order of their reactivity towards HCN cortaldehyde. arstone, methyl tert butyl ketone. A.I.S.B 2012
- 22. (a) Write a suitable chemical equation to complete each
 of the following transformations:
 - (i) Butan and to outsnote and
 - 4-Methylacetophenome to benzene-1.4-decarboxybe and
 - Arrange the following compounds in an increasing order of their property as indicated
 - Benzoic and 3. 4- dimitrobenzoic and, 4-methory benzoic and (and strength)
 - OH, CH, CH Br) COOH, OH, CH Br. OH, COOH, OH, CHCOOH and strength. (A.I.S.B. 2012)
- 28. How will you convert the following
 - /и, Тильене to зению выд
 - .b. Write products of the following reactions



Br_/FeBr_

- .e Which acid of each pair shown here would you expect to be stronger?
 - F 지난, 그미래 한 및 지난 국가에서
 OH



A I S R 2019

- 34. (a) How will you convert the following
 - (i) Propanone to Propan-2-ol
 - n. Ethneni in 2-bydragypropapoir and
 - to, Give simple chemical tests to distinguish between
 - Fentan-2-one and pentan-8-one
 - is Ethanal and propanal

c) Write the products of the following reactions.

A.I. S.B. 2018

- (a, Write the products formed when CH, CHO reacts with the following reagence
 - (i) HCN
- (a) H.N. -OH
- (in CH_CHO in the presence of dilute NaOH
- (b) Give emple chemical tests to distinguish between the following prime of compounds
 Propagal and propagate
- (c) Out of CH₂CH₂—CO—CH₂—CH₁ and CH₂CH₂—GH₂—CO—CH₂, which gives induftion test?

 A LS B. 2014:
- 26. (a Write the structures of A, B. C and D to the following reactions

- (b) Dietanguash between.
 - (i) C_H_CH_CH_COCH, and '_H_CH= 'H_COCH_'H_,
 - (a.) CH_CH_COOH and HCOOH
- (c) Arrange the following in the increasing order of their builting puncts:

сңсқоң сқсосң, сқсоон

Or

(c. Write the chemical reaction involved in Etail reaction.

- b Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction [Health? A.H. 10 H. H. M.H.
- .c) Why is ρK_a of Ci—CH_a—COOH lower than the ρK_a of CH CORDE?
- al) Write the product in the following reaction.

A and B are two functional asomers of compound C₃H₆O. On heating with NaOH and I₂, isomer A forms yellow preruptate of advisors whereas somer B does not form any precipitate. Write one formulae of A and B.

A.1 S B 2016)

27, .a) Write the product(s) in the following reactions

(41) CH₃ CH = CH CN
$$\frac{a_1}{b_1}$$
 DiBal II . 7

- b) Give simple chemical tests to distinguish between the following pairs of compounds
 - O Butanai and Butan-2-one
 - .rs Dessaule solid mark Photon
 On
- at Write the reactions involved in the following
 - Exard reaction
 - Stephen reduction
- b How wall you convert the following in out more than we steps
 - . Benzos and to Beazaldehyde
 - u) Acetophenous to Benzine and
 - an) Ethenor and to 2-Hydroxyethanoic acid.

A.I S.B. 9017

Hints & Answers

for Revision Exercises

Lery Shart Insier Questions

- 1. С, Н, сосн, « сн, сосн, « сн, сно « нено
- 0 40
- 6. L/NeOH (lodeform test)
- 4. (OH.,, CCHO, 2, 2 Dimethylpropand)

ڻ ii

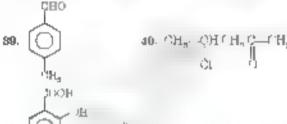
- 5. Cli,CH, CCli,CH, (Pentan-Some
- 6. Diphenyi methane is firmed.

- 7 Pb C CH₂ CH₃ 8.
- 0. butenone < proponene < proponed < ethanol
- C_iH_iCOC_iH_i < C_iH_iCOCH_i < C_iH_iCHO
- 11. 4-Methylpent-5-en-2-one
- .a. 2-Methylpropana.
- 1 Methylcyclohezanone
- CH₀CH₁CHCHO

- S Ammobutanel 16. 4-Hydroxypentan-2-one
- 17 (H₅ n) H₅ + (H₆ H + (H₆ n) H
- .u. 20. C.H.COOH
- 21 But-9-en-dine acid
- 22. CH, COCH, > CH, CHO > CH, COOH
- 20. A HaCONHA BOHAN
- 26. Propane 1 A,3 tecarbusylic and
- 26. 8 Hydroxybutanoic acid. COOH
- 37 S8. 3- Thiorobutanai S9. But-S-anai
- 80. $C_aH_aCOCH_a \xrightarrow{O NH_0NH_0} C_aH_aC = NNH_a$ CH_a OH_a
- 81 'H₂ NAM + H₃ Pri BaSO₄ CH₃ H₄ + H₄N

 Quantities 5 Bithecel

- 82. $CL_2CCOOH \times CL_3CHCOOH \times CRCH_2COOH \times CH_3COOH$
- 88. Pentan-2 4-dione 84. CH₂ CH₂ CH₂ CH₃ CH₄ CH₄
- or canton conton
- 36, 2, 3 Dimethylpenian-Some 37 Penis 2-ens



- 41. (c) 48. (d) 49. (e) 44. (e) 45. (c)
- 48. (b) / 47. (a) 48. (b) 49. (d) 50. (b)
- 1. α) 52. υ 53. e) 54. (b 55. e

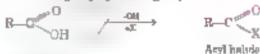
Additional useful Information and Objective Questions

ADDITIONAL USEFUL INFORMATION

JAHO DER VAT VES: NOMENCLATURE AND MUTHOUS OF PREPARATION AND IRROPERTIES

ACYL HALIDES

These are obtained by the replacement of -OH group by helide group



Those are named by replacing the suffix or of the name of the and by yl and adding the name of the halide

CH₂COOH Stringer and

CH,COCI Ethnocyt chkeride

Preparations

Any transfer are easily prepared from each oxylic acids or from their salts by reaction with phosphorus pentachdonde, phosphorus trichloride or through chloride.

IN WITH PCL

The reaction is best carried out with through channels because the other two products are gases. Properties

■ Hydrolysus gives acula

2 Alcoholysia gives estera

5. Ammonolysis gives sundes

4 Reduction gives aldehydes. The reaction is called Rosemmand's reaction.

$$CH_3COCI + H_2 \xrightarrow{Pd/BaSO_4} CH_3CHO + HC$$

Areta de hyde

As ID AMADES

These are the compounds obtained by replacing - OH group of the earboxylic acts by - NH, group

According to RPAC system, these are named by replacing the soding of of the parent bydrocarbon by amide. For example

Preparation.

Anodes are generally prepared by the reaction of anomorus or summes with soid chlorides or and analydrides

Properties

. Amphoteric unture. They combine with acids as well as bases.

2 Hydrolysia

3 Debydratero

$$CH_3CONH_6$$
 12O_3 $CH_3C=N+H_4O$
 CH_3CONH_6 2O_4 CH_4CN+H_4O

4. Action with nations and

Action with Erp and caustic alkaly gives some with one carbon atom less than the anode (Hoffmann bromasnide reaction.)

ESTERS

These are obtained by replacing the 40H group of carboxylic acids by alkazy group R

Esters are named by writing the name of alkyl or anyl group of OR part, before the name of the purem outd and changing the suffex in and to see For example,

CH₂COOH CH₂COOC₃H₃
Ethanoin sent Ethyl ethanoste

Preparation

CH₂CODH + HOC₀H₆ + CH₂CODC₂H₆ + H₂O

Acetic noid Ethyl atorbot Ethyl aretate

The reaction is known as esterification.

ii) From acyl habdee

 $CH_{3}COCI = 4 HOC_{2}H_{6} \rightarrow CH_{3}COCI H_{2} + HC$ Acetyl chloride Ethyl alcohol Babyl acetate

in From anyl anhydrides

Properties

. Hydrolysis can be done in the presence of and as well as base

$$CH_0COOC_2H_0$$
 + H_0O $\xrightarrow{H'}$ CH_0COOH + C_2H_0OH $\xrightarrow{A_1}$ CH_0COOH + C_2H_0OH

2 Amenmolysis to form runde

3. Alcoholyars caune esterologistate

4 Reduction of esters give alcohols

As ID ANHYDRADES

These are the derivatives of currecylor reads obtained by the loss of a molecule of H_{γ}) from the carbonyto groups.

Acid anhydride

These are named as the embydrates of the respective ands both in common and IUPAC systems. For example,

CH,COOH

Stinanous and

CH,CO

CH,CO

Ethanous unhydride

Preparation

: These are prepared by beating carboxylic saids with PaO_a

a) By treating sodium salt of carboxylic acid with acyl halide-

Proporties

Hydrolyaus to give acide.

$$CH_aCCCCCCH_a \rightarrow H_aC \rightarrow 2CH_aCCCCH$$

2. Alcoholysts to give esters

5. Ammonolysis to give amides

NUCLEOPHILIC ADDITION TO 6. B. UNSATURATED CARLONYL COMPOUNDS

 $\alpha \beta$ unsaturated adehydes and ketones are those compounds in which the carbonyl group is in conjugation with carbon-carbon double bond. For example,

These may be represented as resonance hybrid of the following structures:

The resonance structures show bak of β and arrived carbonyl communities e.g. accolors has two electron definent rates C_a corbonyl carbon or C_a carbon β to it. Therefore nucleopade may ettack either at C_a if 2-addition or at C_a if 4-addition giving two different products. When the analoophule is strong, 1, 2-addition predominates we number of addition scross $C \to O$ group. On the other hand if the nucleophule is weak $\alpha, \beta \in \Gamma$. By str. 1, 4-addition predominates, For example,

Ketouer are seas reactive dian aideligides and therefore, prespective of the nature of modeophile 1, 4-addition product predominates.

Such addition of earbanions to α. β- ansaturated compounds are commonly referred to as Michael addition.

Factors governing 1, 2-addition versus 1, 4-addition

- Strong nucleophiles bring about 1, 2-addition.
- 1. 4-odd/fram occurs readily an o. 8-unsaturated belones.
- Stems hindrance at \$\beta\$-passion favours 1. 2-addition while hardrance at the carbonyl group, favours 1. 4 addition.

SOME MORE IMPORTANT REACTIONS WITTIG REACTION

Aidehydes and betones cent with phosphoranes, or abosphorae ybdes, or give aikense and briphenyl phosphora ande, an ybde is a nec on, molecule having negatively charged carbon atom adjacent to a positively charged beterration, abosphorae

It is a good method for preparing alkenes.

BAEYER VILLIGER OXIDATION OF A DEBYDES AND RETONES

Both aidehydes and ketones are condised by peroxy acids. This reaction is called **Baeyer-Villiger oxidation.** For example, benzaldehyde reacts with parmy acids to give benzaldehyde reacts with parmy acids to give benzaldehyde.

This reaction is particularly useful for ketones because it converts them to carboxylic esters. For example, acetophenous reacts with peroxy sends to give phenyl acetate.

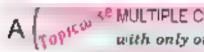
REPORMATSBY REACTION

This reaction involves the addition of an organizatic reagent to the carbonyl group of an addition of an organizatic reagent to the carbonyl group of an addition. The intest peoplet is a suice alkanda which gets hydrolysed to give the β-bydroxy ester.

For example.

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions M. C. Q.



MULTIPLE CHOICE QUESTIONS

with only one correct answer

Aldehydes & Ketones

- A1. Benzene reacts with CH_COCI to the presence of ArCI, or
 - .u Call,Off,
- b Called
- (c) C,H,COOH,
- (a) C_aH_aCOOI
- A2. Aldehydes and ketones andergo
 - a electrophabe addition.
- electrophilic substitutions
- nucleophiae addition.
- audeophilicaubatificion.
- A3. The molecule that can give Caonizzaro's resultin is
 - .c) socialdebyde
- (b) formeldehyde
- butyraldehyde
- d promonaldebyde.
- A4 Which of the following is most reactive towards nucleophilic addition reactions?
 - a) CH, COCH,
- (b) CFLCHO
- c) OH_eCOC₀H_e
- a) HCHO.
- A6. In the carbony group, the carbon atom undergoes
 - a so hybridaetion
- b sp hybridisation
- e sp¹ hybridiention.
- of splat hybridiantion
- Aft. Ketoues are less rescuive than aidebydes because
 - .a) O = O group is less poter in ketones
 - b) of electromeric effect
 - sterr hindrance to the attacking reagent
 - of mone of these
- A7 Which of the following gives radiaform test?
 - a CH₄OH
- 5 CH, COCH, CH,
- e) HCHO
- (d) CH_COOH

- As. Aldehydes and ketanes form hydrocarbons by
 - Jemmensen reduction b Connizzaro reaction.
 - Rassenmund's reduction of Aldel condensation.
- Att. In the following reaction, X as

CH_CH=CH_CH_CH_CH=CHCH_

- A.t. Cvanonydrun of which compound gives actic and on hydrolyera ?
 - a Acetaldebyde
- b Formaldehyde
- (c) Austane
- (d) Propagal
- All. In the reaction

$$HC = CH \qquad \underset{U. \ U_2 \to U_3}{U^{2N_1}} \to X \qquad \overset{AM_1}{\to} Y \qquad \overset{P \ Br_2}{\to} Z,$$

$$Z : g$$

- Ethylidene brounde
- b Ethyl brounde
- Везтоветачия
- d Ethylene brounds.
- A.2. In the reaction
 - 2CH_CCH_ Countret

The product Pile

- (a) CH_COH(CH_)CH_COCH_
- ондоси насидости
- ch_c(ch_) = chcoch_
- $d' = CH_aCH = CHCH_aCOCH_a$
- Ath (c) A9. (d) A1. (c) A2, ...) A8. 61 A4. (d) A5. (b) A7. b AB. sar A10. a

- Pd H₂ BaSO₄ X X as A18. CH, 20CL
 - a ereteldebyde
- propionaldebyde
- eurtrice
- .d acetto ecid
- A14. A ketone reacted with CoH, MgBr reagent followed by hydrolyms gave a product which on dehydration gives an alkenie. The alkene on ozonolysis gives diethyl tretone and acetaldenyde. The ketone is
 - (a) dimethyl ketona
- (b) diethyl kelone
- .c) sthyl methyl ketone
- d) ethyl propyl katone
- A15. Which of the following reagents cannot be used to distinguish between pentanal and pentan-2-one?
 - .c) Tollen's reagent
- (b) Felling solution
- e L in NaOH
- .d) Br. in OCt.
- A16. Butanal undergoes aldel condensation to give
 - a) OH,CH,CH,CHCH,CH,CH,ORO

в сијенден си сијено

OH OH

e OH, CH, CH, CH OHCHO

ep ch'ch'or'ch' ach'ch'or'

- A17. The reaction of formaldehyde with magnesium methyl bromide followed by hydrolysis gives
 - (a) secondary alcohol.
- (b) primary alcohol
- .c' ketone
- d) tertiary alcohol.
- A18. m-Chlorobenzaldeliyde on reaction with cone KOH at monitemperature gives
 - a Polaseoum in chloropenzoste and in hydroxy benzaidebyde
 - b) m-Hydraxy benzaldebyde and m-chlorobenzyl alcohol
 - .c' m-Chlorobenzyl alcohot and m-hydroxybenzyl alcohol
 - d) Potassium michlorobenzoste and michlorobenzyl
- A19. Treatment of propoposidelyrie with dil. NaOH solution gives
 - 6) CH,CH,COO CH,CH,CH,
 - 6 OH, CH, CH(OH CH(CH,)CHO
 - (e) CH_CH_CH_(OH) CH_CH_CHO
 - e a the the booth, att.
- Add. Which of the following will not undergo aldol condenention"
 - a) Acetrudehyde
- (b) Propanaldehyde
- c) Benzaldehyde
- .е/) Ргоринович

- A21. Benzyl alcohol is obtained from benzaldebyde by

 - a Wurtz reaction b Camuzzaro reaction
 - c) Clarsen reaction
- (d) Perkun reaction.
- A32. The aldel condensation of acataldahyde results in the le nodvensk
- r CH,CH,CHC—H
- сн, гн, он + сн, соон

- **A20.** An organic compound of molecular formula C_aH_aO did not give silver mirror test with Tollen's reagent but gives an oxime with aydroxylamine It may be
 - $a^* \text{ CH}_a = \text{CH} + \text{CH}_a \text{OH}$
- - c) OH,COCH,
- (d) CH, -CH-OCH,
- A34. In the Connizearo's reaction given below

2PhCHO Old a PhCH_OH + PhCOO the allowest aten is

- a the attack of OH at the carbonyl group
- the transfer of hydride to the carbonyl group.
- c) the abstraction of proton from carboxylic acid.
- d) the deprotonation of PuCH, OH
- A25. Identify the final product (Z) in the following sequence of reactions

$$Me_qCO + HCN \rightarrow X \xrightarrow{H_qCr} Y \xrightarrow{H_2SC_4} Z$$

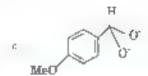
6014

- a (CH_a)_a C(OH COOH ...b) CH_a = C (CH_a)COOH
- e) $HOCH_0OH(CH_0)COOH$ (d) $CH_0CH = OHCOOH$
- AMS. In the reaction

$$C = 0 \qquad \begin{array}{c} \text{KCN, } H_y SO_4 \\ \text{(ii) } LALH_4 \end{array} \rightarrow D$$

- s. CH_CH_CH_CH_NH_ (b) CH_CH_CH_CH_CH_NH_ ÓĦ
- (c) CH_CHCH_CH_NH_ (d) CH_C CH_C C-NH_C
- A27 In a Capacezaro a reaction the intermediate that will be best hydride donar w

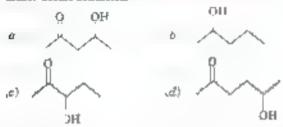




- A28. Cyanohydrin of which compound gives lacke ead on hydrolysis ^y
 - ar Acetaldehyde
- (b) Formaldebyde
- c) Propanal
- .d') Acetone
- A29. An send chluride on reaction with H_p, Pd-ReSO_c gives CH, 12 CHCHO This neid chioride on reaction with dimethyl cadmium in the presence of dry ether, gives
 - a) (CH,,,COH
- (b) (CH_e)_eCHOH
- c) CH_{2/2}CHCOCH₃
- d) (CH_{ch}CHCHO)

Carboxylia Acids

A30. Which of the following will be most readily dehydrated under acidic condition ?



- A81. Which of the following is the strongest acid?
 - a) CH,COOH
- (b) CH_CHCl COOH
- c) OH, CH, COOH (d) CH, CICH, COOH.
- A02. Acetic acid is reduced with LiAliI, to give
 - a OH,OH,OH
- OHOURD (4)
- e) CH₂CH₂
- (d) CH_OH
- ASS. Benzoic and on treatment with HNO, in the presence of H_2SO_s grives
 - a) m-mtrobenzous send (b) mitrobenzeue
 - c) o-mirobenzow wid (d) Benzene emphonic acid
- A84. Benzoic acid reacts with LiAlH, to give
 - a Ethylbenzene
- Methylheczene
- c) Phenol
- (d) Benzyl alcohor
- A85. In the reaction
 - CalOHy CH, COOH-
 - O ta
 - a, CH_aCOONH_A
- (8) CH₂CH₂C NOH
- c) (CH_{aba}C NOH (d) CH_aCONH_a
- f A86. December yiethou of sodium benzonte on heating with soda ume gives
 - a benzene
- b) toluene
- c benzaldehyde
- (d) bearate acid.
- AS7 The reaction

RCOO Ag + Br₃
$$\xrightarrow{GCQ_0}$$
 R—Br + AgBr + CO₃
as called

- to Hunsdiecker reaction
- a: Kolbe a reaction
- Friede) Craft's reprison.
- ed. Wurtz reaction.
- ASS. The reaction

in called

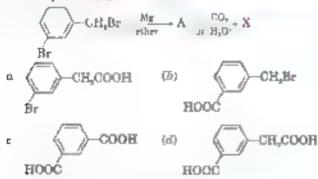
- (a Remor Tiemano reaction
- (b) Hely Volhord Zelmsky reaction
- Castruzzaro a reaction.
- (d' Sandmeyer's reaction
- A39. Vinegar is dirute squeous solution of
 - (a. Etheogic and (b) Bengue and
 - (c) Citrus and
- do Oraan and
- A40. The conversion of a carboxylic and to a-bromonarboxylic ecid meng red phosphorus and bromos u.e.
 - Camazzaro s reaction
 - sha Aidal condensation
 - (c) Heli Volhard Zelinsky reaction
 - 'd' Kolbe a reaction.
- A 4.1 Sahryhe acid on beating with sode ame (CnO+NnOH gives
 - so benzana
- (6) benzoic and
- (c) phenol
- (d) toluene.
- A42. Which of the following is weakest and?

- A48. The strongest said among the following is
 - $(a_{r}, p \cdot Cl + C_{s}H_{s}COOH) = (b) \cdot p \cdot OHC_{s}H_{s}COOH$
 - (c) C,H,COOH
- (d) p-NO₄C₆H₄COOH
- A44. In the reaction

Y :B

- (a) CH_CH_CONH,
- 9 OIL'GH GM:0000H
- (c) CH_(CN)CH_COOH
- (d) CH_c(CN)COOH

A45. The end product (IC) of the reaction as



- A46. Carboxylic acids are reduced by red P and HI to
 - o atkanes
- (b) alrohole
- s nikenes
- d aldelivdes
- A47 In the reaction

The product E is

- a salveylin and b a-cutrobe
 - a-mirobenzour and
- c) anthramile and (d) protome and
- A48. Which of the following has anglest boung point?
 - a CH_COCL
- 9. (OH2CO)2O
- e) CH_COOH (e) OH_CHO
- A49. Which of the following ester does not undergo Classesself condensation?
 - a CH_CH_CH_CH_COOC_H_
 - b) C,H,COOC,H,
 - e CaH, OH, COOC, H,
 - d) Callacting Coocalla

- A50. Which of the following compounds does not have a carbinal group?
 - to Benzoic acid
- 5 Polimitic acid.
- (c) Pierrie acid
- d) Offere oard
- A51. In the reaction

Y 16

- (a) CH_CH_CH_OH
- (δ) CH_g = CHCOOH
- (c) CH,CH,CN
- (q. CH C = OOOH
- A52. Former soul and acetic soul can be distinguished by
 - (a. atmus solulam.
- b) constate sode
- (c) NaHOO,
- d) ammoniacai AgNO,
- ASS. The product as a result of reaction of CH₃MgBr and CO₃ on further hydrolysis gives
 - (a CH_GOOH
- (a) BCOOH
- (c) Onnhe neid
- rl) Benzore and
- A54. Which of the following will not undergo Hell Volhard Zemesky reaction?
 - Propianore and
 - 2, 2-dimethylpropensic acid.
 - (c) 2-Methylpropenose and
 - saf. Butranaic and
- A55. In the compound given below

the correct order of arithty of the position x, y and z is

- BESSSY
- B 82828
- (c) x > z > y
- (d) y > z > z

A45, d) A46, o A47 r A48, r A49, b A50, r A51 b A52, d' A53, e A54, b A55, b

B MULTIPLE CHOICE QUESTIONS

from competitive Examinations

AIPMT & Other State Boards'
Medical Entrance

B3. Acetophenone when reacted with a base, C_pH_pONa, yields a stable compound which ass the structure

(B.S.E. PMT 2008

- 82. The relative reactivities of anyl compounds towards annisophilic substitution are in the unler of
 - a) Ester > Anyl chloride > Anode > And enlightee
 - b) And anhydrafe > Amide > Ester > Anyl chloride
 - c) Acyl chloride > Ester > Acid unhydride > Amide
 - d) Acyl chloride > Acid anhydride > Beter > Amide CBSE PMT 2008
- Bu. Proposic acid with Br./P yields a dibromo product. Its structure will be

Br JOH d' CH, Bri-CH Bri -COOH Br C B.S.E. PMT 2009

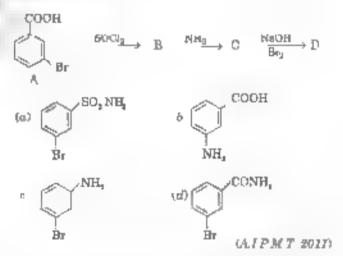
B4. Trubleresestablehyde CCl_sCHO reacts with chinesbenzane in the presence of sulphane seid and produces

- Bo. Which of the following renshous will not result in the Europation of carbon-carbon come?
 - a) Wurte reaction
 - b) Friedel Crafts acylahun
 - c) Reimer Tiemann reaction
 - d) Canasazaro reaction.

CBSE PMT 2016

BS. In a set of reactions, ethyl benzene yielded a product D

BS. In a set of reactions su-bromobenzous acid gave a product D Identify the product D.



- B8. Cleumensen reduction of a ketone is askried out in the presence of which of the following?
 - a) Glycol with KOH
- (b) Zn-Hg with HC1
- ic) LiAlH,
- (d) H, and Pt as catalyst GLIPMT 20.1

- B9. CH₂CHO and C₂H₂CH₂CHO can be distinguished chemically by
 - a. Remediet a cent
- Foderfater: cest
- c) Toilen's rengent sest.
- (d) Fehling's solution lest.

A.I P.M.T. 2012:

B10. Predict the products in the given reaction.

(a) CH₂OH + COOT

(b) CH₂OH + COOT

(c) CH₂OH + COOT

(d) CH₂OH + COOT

Bil The correct order of decreasing soid strength of trichloroscetic and A , withurconcetic and B , sector and

C) and forme and (D) is

- n BanaDan
- b B > D > C > A
- c) A > B > C > D

ÒН

id A > C > B > D

ALPMT 2012

B12. Reaction by which benzaldeligds cannot be prepared

+ CO + HCl in presence of anhydrous AlCl,

COOH

+ Zat/Hg and come HCl

NEET 2018

B13. Which one is most reactive towards nucleophilic addition reaction?

(z) DHO

(6) -800H

CHO

OH.

(d) OHO

(A1 f MT 2014

B14. Which of the following will not be soluble at sochain bydrogen corbang a 2

as 4,0 Transcoptional

- Ведамо вый
- (c) o-Natrophenol
- (d) Benzenemiphonic acid

AIPMT 2014)

- B15. Reaction of a carbonyl compound with one of the following reagents involves nucleophilic addition followed by elimination of water. The reagent is
 - for hydrocynnic acid
 - (b) sodium hydrogen suiphite
 - (c) a Grigmand reagent
 - (d. hydrazine in presence of feebly acidic solution

A.t.P.M.T. 2018

- B16. An organic compound X having molecular formula $C_5H_{10}O$ yields phonylhydrazone and gives negative response to the induform test and Tollens test. It produces no pentage on reduction. X' could be
 - fa. pentan-3-ane
- (b) a-nmyl alcohol
- (c) pentanal
- d) pentan-2-one

AIPMT 2015

B17 Given

CH₂ CH₃
CH₃
CH₄
CH₅
CH₆
CH₇
CH₇
CH₃
CH₃

Which of the given compounds can exhibit tautomerism?

- fay II and III
- (b) I, II and III
- (c) I and II
- (d) I and III

AIPMT 2016)

B15. A single compound of the structure

s obtainable from exemptions of which of the following evolve compound?

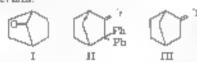
$$b = \bigcirc_{CH_0}^{CH}$$

fithrum gives which of the following species?

- α/ Cyclopentanouyl radica.
- Cyclopentagonyl biradical
- (e) Cyclopentanonyl anion
- W. Cyclopentanough cutton

A PMT Wife

Bib. Which among the given insecules can exhibit causing rain?



for III only

(b) Both I and III

for Both I and II

tal. Both II and III

WEET BOID

Bill. The correct statement regarding a carbonyl compound with a bydrogen alom on its alpha-carbon, is

- for a carbonyl compound with a hydrogen atom on its aigne-carbon rapidly equalitrates with its corresponding enol and thus process is known as carbonylation
- The electronyl compound with a hydrogen atom on the alphe-carbon rapidly equilibrates with its corresponding end and this process is known as keto-end tautomerican
- e carbonyl compound with a hydrogen stom on its alpha-carbon caver equilibrates with its corresponding engl
- 'd, a carbonyl compound with a hydrogen atom on its alpha-carbon rapidly equilibrates with its corresponding and and due process a known on aldebyde-ketona equilibration. (NEET 2016)

B22. The product formed by the reaction of an aldehyde with a primary amore is

- a carboxylic and
- (b) aromatic sed
- r Schuff's base
- (d) ketaon (NEET 2016)

B23. The correct structure of the product A formed in the reaction

B24. The IUPAC name of the compound

- fix) 2-formyther-2-en-3-one
- b 6-methyl-4-papliex-2-en-6-nl
- (c) 8-keto-2-methylhex-5-eusi-
- (d. 3-keto-2-methylhez-4-ene)

OVEET 2017)

B25. Predict the correct intermediate and product in the following reaction

$$\begin{aligned} \mathbf{H}_{0}\mathbf{G}-\mathbf{G}=\mathbf{G}\mathbf{H} &\xrightarrow{\mathbf{H}_{0}\mathbf{G}_{0}\mathbf{H}_{0}\mathbf{H}_{0}} -\mathbf{Intermediate} \\ &\downarrow \\ &\mathbf{Product} \end{aligned}$$

$$^{(g)} \ A \ H_0C - C = CH_0$$

$$\mathbf{B} \ \mathbf{H}_{\mathbf{a}}\mathbf{C} - \mathbf{C} = \mathbf{C}\mathbf{H}_{\mathbf{a}}$$

$$\mathbf{SO}_{\mathbf{a}}$$

$$c = A H_8C - C = CH_2$$

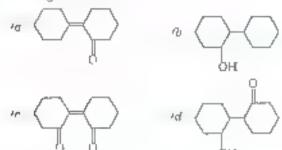
OH

OH

U

(NEET 2017)

B26. Of the following which is the product formed when cyclohexanons undergoes aidol condensation followed by benting?



NEET 2017

B27. Consider the reactions

Identify A, X, Y and 2

- (a) A-Methoxymethane, X-Bthanol, Y-Ethanol acid,
 3. Succerbanda
- 7b. A.-Ethanai X.-Ethanni, Y. But-2-enal, Z.-Senucarbazone
- A-Ethanol, X-Acetaldehyde, Y. Butanone,
 Z-Hydrasone
- (d) A. Methorymethane X-Ethanoic and, Y. Acetate um, Z-Hydrazuse. OvEET 3017
- R28. Compound A, C₈H_MO, is found to reset with NaO_A produced by reacting Y with NaOH) and yields a yellow precipitate with characteristic small. A and Y are respectively

- B29. Carbocylic acids have higher boiling points then aidelydes. ketones and even alcohols of comparable molecular mass. It is due to their
 - for formation of intramolecular H-bonding
 - (b) formation of carboxylate ion
 - fc) more extensive association of carbodylic scid via van der Wasle forces of attraction
 - the formation of intermolecular H-bandang

NEET 9018)

BSO. $CH_2OHO \rightarrow HCHO \xrightarrow{dl. NoOH} A \xrightarrow{HCN} B$ the state of compound B is

сн, сн, сн соон

Kerala P M T 2005

OH

B81. Arrange the following saids in order of their movesting

- O AKB C D
- & B < C < A < D
- (c) C < B < D < A
- (d) 0 < 0 < B < A

AM U 2011

B82. 5-expheranal is obtained by examples of

AM L Med 2013)

- B80. Which of the following carboxylic acid undergoes decarboxylation easily?
 - a CaHaCOCHaCOOH
- (a) CaHaCHCOOH

ιН

r C_aH_aCHCOOH

d C.H.COCOOH

NH.

A.M U Med 2015

- B34. When a maxture of bearaldehyde and accomplement is treated with dilute NaOH at 298 K, it forms
 - /zz 2, 3-daphenylproponal
 - 1, 1-dephenylpropan-2-nos-1-n
 - (c) 1. 8-diphenylprop-2-en-1-one
 - (d) 1 2-diphenyiprop-2-en . one
 - 'e . 3-diphenytprop-2-en .- al-

Kerato PMT 2015.

JEE (Main) & Other State Boards' Engineering Entrance

B35. In the following sequence of reactions, the alkene affords the compound 'B'

 $CH_1CH \longrightarrow CHCH_1 \xrightarrow{Q_1} A \xrightarrow{H_2G} F$

The compound B is

- a) CH,CHO
- (b) CH_CH_CHO
- e) CH₂COCH₃
- (A) CH2CH2COCH

A.I.E.E.E. 2008

- **B86.** One mole of a symmetrical albene on econolism gives two moles of an ablebyde beyong molecular mass of add. The albene is
 - .s But-2-ene
- (b, Ethene
- .c) Propens
- ,d) But-L-ene

A / E E E 2010

- B37. The correct order of increasing beautity of the given conjugate bases $(R = CH_{\pi})$ is
 - a) $RCOO^{\circ} < NH_{\circ} < HC = C^{\circ} < K^{\circ}$
 - (b) RCOOT < HC = C < NH_a < R^a
 - .c) RCOO < HC = C < R < NH
 - (b) R < HO = O < RCOO < NH (A.I E.E.E. 2010)
- B38. Which of the following rengents may be used to distinguish between phenol and beazus acid?
 - a) Aqueous NaOH 💉 🗸 (b) Tollen's reagent
 - .c) Mohach reagent
- d) Neutral FeCl

AIREE 2013

D89. Trichloroacesaide) yee was subjected to Caumizanous reaction by using NaOH. The maxture of the products contains sodium trichloroacetate for and another. compound. The other compound is

- a 2,2,2-truchiorosthenoi
- 6) brichloromethanol
- 2 9,2-inclusionsprepage!
- d) chroroform

(A! E.E.E. 2011

B40. In the given transformation, which of the following is the most appropriate reagent?

FIO CH = CHCH, Eegent

(a) Zo-Hg/HCl - (b) Na, liq. NH, (c) NnPH, (d) NH,—NH,/OH

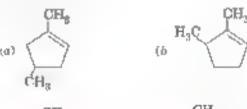
A7EEE 2013)

B41. Compound A2, C₈H₈Br, gives a light yellow precipitate when warmed with alumbotic AgNO₃. Oxidetion of (A gives an and B, C₈H₈O₄. (B) easily forms subydride on beating. Identify the compound. A)

B43. In the reaction

CH_COOK: $LANE_4 \rightarrow A$ $PCl_6 \rightarrow B$: Alc. EOR + C, the product C is

- (a) acetyl chloride
- 16. acetaldehyde
- (c) acetylane
- (d) ethylenel/EE Main 2014)
- B40. Which compound would give 5-keto-2-methyl-hexans. apon azonolysis?





(JEE Main 2016)

B44. In the following asquence of reactions

Toluene $\xrightarrow{\text{KMnO}_4}$ A $\xrightarrow{\text{SOCI}_3}$ B $\xrightarrow{\text{H}_2/\text{Pd}}$ $\xrightarrow{\text{BaSO}_A}$ C the product (C) in

- $\sigma = C_0 H_0 \cap H_0 \cap H$
- _{ው የተ}ፈናቸው
- € C_sH_sCOOH
- (d) C_aH_bCH_a

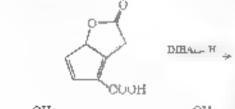
'JEE Main 2016.

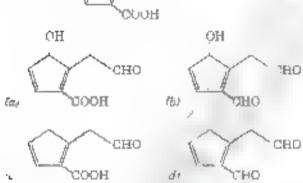
B45. The correct sequence of reagents for the following conversion will be

- ta, AgrNH, J OH H /CH, OH, CH, MgBr
- (b) CH₆MgHr H⁺/CH₆OH Ag(NH₆I₆I)[†] OH
- 'c CH_sMgBr AgtNH_{3 gt}+OH· H•/CH₃∋H
- rd Ag(NH_{v0},*OH; CH₃MgBr H*/CH₅OH

JEE Much 2017

B46. The major product obtained in the following reaction is





JEE Main 2017

- B47. Which of the following pairs can be durtinguished by sodium hyporodita $^{\circ}$
 - a) OH, CHO and CH, COCH,
 - .6 ОН СН СНО выб СН СОСН,
 - .e OH_CH_OH and CH_CH_CHOHCH,
 - .d) CH_OH and CH_CH_LHC
 - (e) CH,OH and CH,CH,CH,OH Kernia P E.T 2011

- B48. The relative acidic strengths of benzon acid, o-toluc acid and p-toluc acid is of the decreasing order
 - (a, p-talme seid > a-tolure seid > beassic and
 - (b) o-toluic seid > p-toluic acid > benzoic acid
 - (c) p-teletic acid > beasaic acid > a-talaic acid
 - (d' o-toluic seid > benzous neid > p-toluic seid

Karnataka C.E.T Polit

- B49. Upon treatment with I₂ and squares NaOH, which of the following companies will form indefine?
 - a, CH,CH,CH,CH,CHO
 - b, CH,CH,COCH,CH,
 - ch_ch_ch_ch_ch_ch_oh
 - d) CH₂CH₂CH₃CH₃OH)CH₅ (W.B.J.R.R. 2012,
- Bôt). Which of the following dies not give Camezaru's reaction?
 - g p-NO_x-C_xH_x-CHO
- (P) O'H'GHU
- e) HCHO
- (d) CH,CHO

Odisho J E E 2012:

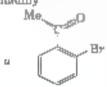
- P51. A carbonyl group can be converted into CH₂ by
 - m NH NH /HCL
- (b) Zn-Hg/cour- HCI
- (c) H_/NL
- (d) laAiH,

Odialia J.E.E. 2012

- B51. In the following species, the one which is likely to be the intermediate during beazons condensation of contembeligue, is
 - gl Ph-Ce O
- (b) Ph-C. CK
- r) Ph-C CN
- (d) Ph-C=0

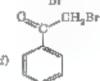
/W R. JEE Engg 2013)

B50. Bromanation of PhCOMe in acetic acid medium produces mamb









(W.B. JEE, Engl. 2013)

- B54. The correct increasing order of the scid strength of benzoic and II., 5, ±-diminobenzoic and III and 4-methoxybenzoic and IV) is
 - (a) 1 < 0 < 10 < IV
- $00 \quad \Pi < \Gamma < IV < I\Pi$
- (c) IV < I < II < III
- d) IV < H < I < H
- (e) 1 < IV < II < III
- Kerata PET 2014

I. umu. H_80., B55, O_H_OOOH - NH

- a o-bromosulphantlic neid
- autopanilnande
- aulphanilic and
- a) p-bromreniphanilamide

(Kanataka CET 2014)

Bot. Among the following compounds, the one(s) that gives give) effervescence with aqueura NaHCO, solution is (are

(a) (CH,CO),O

(h CH,000H

ari) PhOH

(w) CH_COCHO

e) | and a

(b) (c) and (a)

(ii. ylao 15.

d) (t) and (tt

(WB JEE 2014)

B57. An organic compound with the molecular formula CoH_eO forms 2, 4-DNP derivative, reduces Tollen's reagent and ansfergres Cranizzaro reaction. On vigorous condebna, et gress S-benzenedrearborylic acid. The organic compound is

- a) 2-ethylbenzaldebyde.
- (b) 2-methylbenzaldebyde
- c neetophenone
- (d) S-methylbenzakiehyde
- .s phenylacetaidehyde.

(Kerala PET 2014)

B58. Identify the combination of compounds that undergo aidol condensation followed by debydration to produce bur-2-eng

- a. Methanal and ethanal
- 5 Two moles of ethernat
- c) Methanal and propanone
- a) Ethana and proposione
- e) Two modes of ethernol

(Kemlo PET 2014

 $L^{CH_1H_2B_2} \to \mathbb{R}^{-1} \xrightarrow{ADN-CH} 4$ -methylpent-3-m-2-mus B59. P

PIB

- (c) propriotos
- (b) etherremone
- (c) ethanembile
- loandle Oo.

Kamalaka CET 2014

the product of the above reaction in

B61 Amongst the following compounds, the one that will not respond to Councizary reaction upon breakment with alians as

of the CHO

5 Megali Ho

& C.H.CHO

(d) HCHO (WB JEE 2010)

B63. Ozonelysus of an alkane produces only one dicarbonyl compound. The structure of the alkene is

'α CH_a—CH—CH- CH_a



 $(d-1)H_a+(1)H=(1)H-(1)H+(1)H_a$

/WB JEE 2016:

B63. Which one of the following involves nucleophilic addition?

- Knibe's cenetarm of phenoi.
- 4. Wahamson a synthesis of ethers
- 'c. Raimer-Tiemann reaction of obeset
- (d) Kolber electrolytic synthesis of ethane from sodium. arelete
- 's: Audol formation from ethanal (Kerola PET 2016)

B64. An organic compound X is exidised by using suchified K.Cr.O. solution. The product obtained reacts with phenyl. hydrazine but does not answer silver mirror test. The compound X is

- ргорап-2-ог
- 5 ethanai
- (c) because on
- (a. CHICHICH,

Namataka (. E T 2016)

Predict the product 'C' in the following sense of reactions:

- 767 CH_CH(OH)C_H_
- (e) CH₂CH(OH)C₂H₀
- d, (OH_{afr}C(OH)C_aH_a

/Karnataka C E T 2010-

B66. For the reaction below

the structure of the product Q is

WH JEE 2017)

- B67. Cannizzaro's reaction is an example of auto inidation.
 - (a) It is a typical reaction of suphatic aidehyde.
 - 7b, It is a reaction answered by only aldebydes not concaring o-bydragen
 - to. It is a reaction answered only by aromatic aldehydes.
 - *d. It is a reaction answered by all aldebytes

Kernaleka CET 2017

- B08. The emdensation reaction between one equivalent of arctime and two equivalents of bearaldshyde in presence of data albab sends to the formation of
 - (a) benzalacetophenoue
 - & benzylidenescetone
 - ic beazon and and acetic and
 - d amy benzoic and

Norma P.E.T. 2017

- B09. In the IUPAC system, PhCH_aCH_aCO_aH is named as
 - for 3-phenylproponour acid
 - (b) beinzylnestic acad
 - fc, carbozyethyl benzene
 - (d) 2-phenylpropadou acul.

W B. J.E.E 2017

- B70. The correct order of acid strengths of benzons and (X), peroxybenzous acid (Y) and p-microbenzous acid (Z) is
 - 10 X > 2 > X
- ъ Z » Y » X
- @ Z>X>Y
- W Yaxaz

W B. JEE, 2017

B71 The reaction sequence given below gives product R.

The structure of the product R is

- B72. Lower members of eliphatic carboxylic acid are soluble in water. This is due to
 - to formation of hydrogen bonds with water
 - b wondon former
 - for water is non-electrolyte
 - (d. Van der-Wards interaction with water molecules

Kamataka CET 2017

B78. In the following sequence of reactions,

$$CH_0Br \xrightarrow{EGN} A \xrightarrow{P_1C} B \xrightarrow{\omega ADI} C$$

The and product C is

- /a, methana
- (b) ethyl sicobol
- (c. acetone
- (d. acstaldehyde

(Karyataka C.E.T. 2017:

B74. X and Y in the below receptor are respectively

BibCl

O₀H_a CO₂H + X ^{look} → C₀H₀ COCI

- F₁, P&DaSO₄ Y
- (a, SOOL, and C₆H₆CHO
- $(b, (COOL_{ij})$ and $C_iH_iCH_j$
- to 800lg and CaHa "Ha
- (d) COCL, and LH, CH, OH
- (e. SOOL, and C.H.CH.CI

(Kerala P.E.T. 2017)

B75. The correct increasing order of the acid strength of acids, butyrin send (I), 2-chlorobutyric acid (II), 3-chlorobutyric acid (IV) is

$$\sigma = 1 \times H \times \mu H \times HV$$

- 46 III ∈ II ∈ IV ∈ I
- 4 1 < HI < B < IV
- (d) III < I < iI < IV
- (a) IV < III < II < I</p>

(Reralo PET 2017)

B76. $C_4H_{10}O \xrightarrow{K_2C_2O_2} C_4H_0O \xrightarrow{42/NaOH} CHI_5. Here, N is$

WB JEE 2018:

B77. The currect order of reactivity for the addition reaction of the following carbonyl compounds with ethyl magnesium adde is

- $qr \mid r \mid M > R > \Gamma V$
- □ IV ~ III > II > I
- $w = 1 \times \dots \times IV \times \dots I$
- $*d: \mathbb{H} \times \mathbb{H} \times \mathbb{I} \times \mathbb{I} \times \mathbb{I} Y$

AMB JEE 5018

B78. [P]
$$\xrightarrow{\text{He}_3}$$
 $C_8\text{H}_4\text{Rr}_6$ $\xrightarrow{\text{NoNH}_3}$ (\mathbb{Q}) $\xrightarrow{\text{SirkH}_8\text{SO}_4}$ (\mathbb{R}) $\xrightarrow{\text{Ep. HgrHCl}}$ (\mathbb{S})

The species P. Q. R and S respectively are

far ethene, ethyne, ethanal, ethane

6. ethane, ethyne, ethanai, ethene

fc. ethene, ethyne, ethanal, ethanol

id ethyne ethane ethene ethanni

WE JEE 2018.

B70. Which of the following compound andergoes halofurni reaction?

W CH, COCH,

(b) HCHO

(e) CH_aCH_aBe

(d) CH, -O--CH,

Karnotaka CET 2018

B80. The appropriate reagent for the following transformation

a Zn-Hg/HCl

b. H.N. NH., KOHzethylene glyror

e Ni/Ha

(d) NuBH,

(Karnataka CET 2018)

B81. The compound that does not undergo haloform react on is

(a) socialdebyds

rig etherol

ं वाक्सियाव

/cl. acetophenous

ce propiophenone

Kerala PET 2018.

B82. The ense of bydrolysis in the compounds:

CH,COOC,H, III and CH,CONH, IV is of the order

 $a: I \rightarrow H \rightarrow H H \rightarrow IV$

B R > H > H > I

(c, I > II > IV > III)

of a | > IV > III.

W B JEE 2018

JEE Advance for HT Entrance

Major product 12

I T 2008

B83. The order of reactivity of phenyl magnesium brounds with the following compounds is

a I > III > I

A In III all

In > I > III

n' All react with same race

d. T 2004

885. The correct andity order of the following is

 $az = \Pi I > \Gamma V > \Pi > I$

b Iv > III > I > II

(e) III > II > I > IV

of Hadinarian

JIT 2000

B86. In the following reaction sequence, the correct structures. of E. F and G are

$$\begin{array}{c|c} & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & \\ & & \\$$

*implies 15C labelled carbon.

B87. The major product of the following reaction is

a) a benuncetal

en edlær

(a), son scenar

.d eu eeter

B88. Among the following compounds, the most scide is

a' p-aitmaheadl

(b) p-hydroxybenanic arid

ic a-bydroxybenzoic arid

d p-tobuse and

B89. The compound that undergoes decarboxylation must readily under mild condition is

B00. The number of aidol reactions that owner in the given transformation is

æ. İ 3

11 T JE.E. 2012 d) 4

B01. The major product H of the given reaction sequence of

 $CN \rightarrow G \xrightarrow{\text{Poly} H_2 \otimes U_q} H$ CH, CH, CO-CH,

a Cha Ch = (-COOH

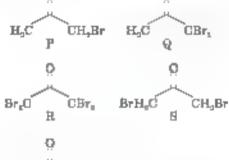
Cin

OH

CH, CH, C JOOH

CH

B02. After completion of the reactions I and II) the organic compound(s) in the reaction mixtures is lare)



- a, Reschool Pand Reschool P
- Reaction I Uncelline and Reaction II Q, acetons
- c) Reaction I T, U, acetone and Reaction II P
- d) Resolute 1 R aretone suri Reaction II 3 aretone JEE Advance 9015

æ

- Bits. The compound that does not aberate CO₂ on treatment with aqueous sodium bicarbonate solution, is
 - a benzoic acid
- .b. bearenesulphonic and
- c, salurylin and
- (d) carbote acul phenus

*JEE Advenced 2015

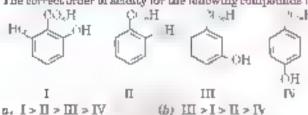
B94. The major product in the following reaction as

JEE Advance 2014

B95. The major product of the following reaction is

AEE Advance 2015.

B96. The correct order of andmy for the following compounds is



c III > IV > il > .

d som > IV > Is

(VEE Advance 2016)

B07. Reagent(s) which can us used to bring about the following transformation s are

- at LaAtH, m 'O,H,1,O
- .6) BH₃ in THF
- e NaBH, in CaH, OH
- (d) Bansy NVH, in THF

JEE Advance 2016:

BOS. The major product of the following reaction sequence is

(JEE Advance 2016)

BBB. (d) BR4. (1)

B95, (a)

MULTIPLE CHOICE QUESTIONS with more than one correct answer

- C1. The Cannazzaro reaction is given by
 - (z) benzaldebyde
- (b) aretaldehyde
- .c neetone
- d) trimethyl acetridehyde
- C2. Aldol condensation is not given by
 - .c benzo phenone
- (b) acstophenone
- benzaldebyde
- (d) propanal

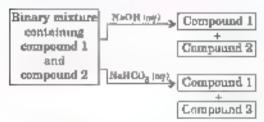
- C3. Tautomersetion is exhibited by

CL in di

C2 a.c)

C8. (a. c)

C4. Identify the binary minturess) that can be separated into individual compounds, by differential extraction, as shown in the given scheme



- (a) C_aH_aOH and C_aH_aCOOH
- .b) C_0H_0COOH and $C_0H_0CH_2OH$
- (e) C_aH_aCH_aOH and C_aH_aOH
- ab Calla CH, OH and Calla CH, OOOH GLT J.E.E. 20.2
- Co. With reference to the athema given, which of the given statement of about T U. V and W is are) correct?

- .c. T is soluble in hot aqueous NaOH
- b) Use optically ective.
- .c. Molecular formula of W is $C_{\rm in}H_{\rm is}O_4$
- .d) V gives effervescence on breatment with aqueous NeHCO, III JEE 11.12
- C6. Acetophenone is prepared by
 - a' heating benzoy, chloride with dimethyl cadmium
 - b) treating bearnyl chloride with excess of CH₃MgI followed by hydrolysis
 - c) treating benzene with excess acetyl chloride in presence of anhydrous AlCl₂
 - z) reducing benzoyl chlorida with H, in the presence of Landlar catalyst
- C7, Which of the following statements are correct?
 - p-fluoro benzore acid is weaker acid than p-chloro benzore acid
 - Chlorowethe acid as weaker acid than dichloro scatte acid
 - e By passing CO through equeous NaOH solution at 475 K under 10 atm pressure, forme acid is formed
 - d) Caiman avetate on heating gives acetic and
- C8. Choose the correct statement(s) among the following.

- (b) CH₃CHO on reaction with HCN gives recenile marture
- (c) CH_s C—H and H—C—OH OH CH.
- (d' CH₃—CH=NOH shows geometrical isomerism.

 /WB JEE 2016
- Co. Positive Tollens cost as observed for

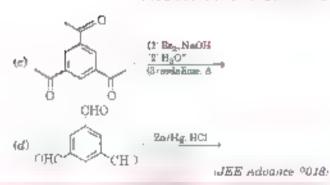
JEE Advance 2010)

C10. Compounds P and R upon econolysis produce Q and S respectively. The molecular formula of Q and S is C₂H₂O Q undergoes Cannizzero reaction but not haloform reaction, whereas S undergoes haloform reaction but not. Januazzaro reaction.

The optionis with suitable combination of P and R, respectively is lare

(JEE Advance 2017)

C11. The reaction s., leading to the formation of .3, 6-trimethylbenzeus in are)



C11 a b.d.

D MULTIPLE CHOICE QUESTIONS based on the given passage/comprehension

Равзиде 1.

A carbonyl emopsind, P. which give positive indeform, set undergoes reaction with MeMgHr followed by dehydration to give an otefin $\mathbb Q$. Oznadyma of $\mathbb Q$ tends to dicarbony: compound $\mathbb R$, which undergoes in ramiolecular additionation to give predominantly $\mathbb S$.

P
$$\stackrel{i}{\underset{\sim}{\longrightarrow}} M \circ M g B c \rightarrow Q$$
 $\stackrel{i}{\underset{\sim}{\longrightarrow}} O_{i} \rightarrow R$ $\stackrel{i}{\underset{\sim}{\longrightarrow}} O \rightarrow S$
 $2 \cdot H_{i} S O_{i} A$

Answer the following questions:

D1. The structure of carbonyl compound P is

D2 The structures of Q and R respertively are

D5. Structure of product S is

Pussage IL

In the following reaction sequence, the compound J is an intermediate

 $J = {}^{\circ}_{A}H_{g} {}^{(\circ)}_{g}$ gives effertescence on treatment with NaHi ${}^{\circ}_{A}$ and a positive Baeyer's cest.

Answer the following questions

D4. The compound I ta

D5. The compound K in

Passage III.

P and Q are isomers of dinarboxylic and C₄H₄O₄. Both decohorize Br₂/H₂O. On beating, P forms the cyclic subyttrile. Upon treatment with dilute alkaline KMnO₄, P as well as Q

could produce one or more than one from S, T and U

Answer the following questions

- D6. Compounds formed from P and Q are respectively
 - ophrally active S and ophrally active pair 'T I
 - (b) optically inactive S and optically mactive pair 'T U'.
 - to optically active pair T U and optically active B
 - di optically inactive pair T | and optically another 9
- D7 In the following reaction sequences v and W are respectively

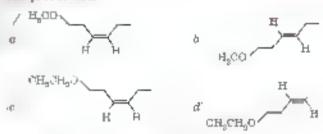
JEE Advance 2018.

Passage IV

Schemes 1 and 2 describe sequential transformation of alkynes M and N. Consider only the ranger products formed in each step for both the schemes

Answer the following questions

De. The product X is



- Do. The correct statement with respect to product Y is
 - (a) it gives a positive Tollens test and is a functional isomer of X.
 - 40 it gives a positive Tollers cest and is a geometrical isomer of X.
 - (c) it gives a positive iodoform test and is a functional tentier of X.

Possenge V

in the following reactions:

Answer the following questions

D10. Companied X in

D.1. The major compound Y is

JEE Advance 2015.

Passage VI.

Columns 1, 2 and 3 centrain starting materials, reaction conditions, and type of reactions, respectively

Column 1	Columa 2	Column 8
· T Taraeae	NaOH/Br ₂	P Condensation
II Acetaphenone	ra Bryliv	Q Carboay nting
· 11 Benzoldebyde	сы,соск	R Substantion
Iv Phenol	Lv. Nac H/CO ₃	S dieleform

Answer the following questions:

- Did. The only correct combination in which the reaction proceeds through radical mechanism is
 - a (II ii. R)
- (b) (III (n, (P)
- e: (IV) (L.Q)
- (d II) (0 (R)
- D.3. For the synthesis of benzois and, the only correct combination is
 - a (III) fav, R,
- b) (TV) (ii) P)
- (B. (E) III) (5)
- (a) (f) (iv Q)
- D14. The only correct combination that given two different carboxylic acide te
 - a (IV) in. Q
- b) (I) (i) (S
- c) (III) (iii) (P)
- 20 (II (tv (R

WEE Advance 9017)

Passage VIII

The reaction of compound P with $CH_{\bullet}M_{\mathbb{Z}}Br_{\bullet}$ excess, in $(C_{\bullet}H_{\bullet})_{\bullet}O$ followed by addition of its gives Q. The compound soon breakment with HaSO, at 200 gives R. The reaction of R with CHaSOC in the presence of anhydrous AiCl, in CH₂Cl₀ followed by treatment with Hampertures compound S. Et an engineered Passet of group.

Answer the following questions:

- D15. The reactions, Q to R and R to S, are
 - (a) Friedel-Crafts alkylation and Friedel-Grafts adjustion
 - (b) dehydration and Friedel-Crafts arylation
 - (c) Friedel-Crafts alkylation, dehydration and Friedel-Crafte ecylation
 - td' aromatic sulphonation and Friedel-Crafts acylation

Diff. The product S is

(JEE Advance 2017

Papsage VIII

Treatment of benzene with CO/HCl in the presence of anhydrous AlCL/CuCl followed by reaction with Ac.Or NaOAc gives compound X as the major product. Compound X upon reaction with $Br_{\phi}/Na_{\phi}CO_{\phi}$, followed by heating at 473 K with most KOH formsbes Y as she major product Reaction of X with Ha/Pd C followed by HaPO, tocatment gives Z as the major product.

Bi7. The emorpound Y is

(JEB Advages 2018)

D18. The compound Z as

Possege VIII. B17- c)

D18. 5

Assertion Reason Type Questions

The questions given below rounst of an Assertion and Reason. I se she following key to choose she appropriate answer

- α If noth assertion and reason are CORRECT and reason is the "FRRECT explanation of the assertion."
- for If noth assertion and reason are ARE, T to a reason is NOT THE CORRECT explanation of the assertion
- (c) If asserting as CORRECT but, reason is INCORRECT
- (f) If assertion is INCORRECT but, reason is CORRECT
- in. If both assertion and reason are IN "CRRECT
- Assertion t Pentan-2-one can be distinguished from pentatic-d-one by rodulors.
 - Reason : Former is methyl hetone while the latter
 as not
- Assertion In methansi, and the four around are at the same plane.
 - Reason The caroon sign in methania is sell by briding d.
- 3. Assertion Benzandelivde is more reactive than propagat towards nucleophilic addition
 - reactions.

 Reason Eenzardabyar is reas stemcally analyed.
- Assertion | Acetaldehyde undergres aidal confensation with da. NeUH.
 - Reason Ardshydes which donot contain a hydrogen undergo aidor condensation.

- Assertion Reduction of 3-phenylprop-3-ensi with LaAlH, gives 3-phenylpropas-1-or
 - Reason : Both aldehyde group and double bond of α, β-unsaturated aldehydes are reduced by LaAlH,
- 6. Assertion Cross Cannizzaro's reaction between methanal and benzaldehyde gives benzyl shooten and formate inc.
 - Reason Benzeldehyde does not consam α-bydrogen atom
- Assertion The pK_x of acetic acid is lower than that of phenol
 - Reason Phenomide ion is more resonance anabilized than scetate ion. (A.I.I M S. 2004)
- Assertion Benzoic and and phenoi on, or distinguished by NaHCO.
 - Reason # Benzinc and is stringer and than phenol
- Assertion Fluoroacetic acid is stronger acid than chloroacetic acid.
 - Reason due to greater electron donaung effect of F from Cl.
- 10. Assertion : Ethenoic and liberates hydrogen with notion metal
 - Reason Sodaum is an alkali metal.
- 11. Assertion Acetic acid does not andergo baloform
 - Reason Acetic acid has no h-hydrogen atom
- Assertion Areas and is wanker and than CH,CH,COOH.
 - Reason : dute to +I effect of methyl group

Matrix Match Type Questions

Each question contains statements given in two columns, which have to be matched. Statements in Column I are subsued as A, B, C and D whereas statements in Column II are labelled as p, q, r and c. Match the entries of Column I with appropriate entries of Column II. Each entry in Column I may have one or more than one currect option from Column II. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

	P	9	r	S
A	(P)	(9)	(1)	(B)
В	P	9	0	(8)
С	(P)	(1)	(1)	(3)
D	(P)	9	0	(S)

If the correct matches are A-q. A-r, B-p. B-s. C-r. C-s and D-q, then the correctly bubbled matrix will look ake the following.

 Match the compounds/ions in Column I with their properties/resolions in Column II.

Column I	Column II
(A, C,H,CHO	(p) gives precipitate with 2, 4-DNP ,q gives precipitate with AgNO,
(C) CN-	(r) is a nucleophile
(D) F	(s) is involved in sympohydrin formation.

Match each of the compounds given in Column I with the reaction(s), that they can undergo, given in Column II

Column I		/ Column II
A) D	(p)	Nucleophilic substitution
(H)	(g)	Ekmasion
G CHO	(r)	Nucleophilic addition
(D) Br	a)	Esternioshon with section
1402	(0)	debydrogenation

1 A o s	B) = 0"	C 4 + 5	D' 9 P	
(2) A g q ,	B) ,p s f	C ris	$L = \rho i$	

Matching List Type Questions

The following question has two matching sists. Choices for the currect combination of elements from Lint-I and Lint-II are given as options which is a correct

1 Different possible herman decompose on probways for percapeaters are shown below. March each pathway from Last I with an appropriate structure from Last II and select the correct enswer asing the code given below the lasts.

	Läst-	[Last-[]	n
æ	Pathy	vay P		1.	C ₆ C ₅ CI	H _o Loron 1H _s
Q	Pathy	eny Q		24	C₅H₅ ^	Lower,
۶R	Pothy	rny R		3,	C _s H _a C	H, CH, CH, CH,
/gh	Pathy	≠ncy S		4.	C₅Ħ₅~	CH,
	Code					
		P	ď	R	S	
		I	0	4	2	
	h	2	4	7	٦	
	.6"	4	1	1)	3	
	an a	8	2	1	4	(JEE Advancea 2019)

2. The desired product X can be prepared by reacting the major product of the reactions in Last-I with one or more appropriate reagents in Last-II given, order of migratory epititude: aryl > alkyl > hydrogen

Laut-I	Last-II
F Ph Me + H,SO,	1 I _s , NaOH
HLN Ph HNO,	2. Agr NH _{3/2} IOH

Laut-I	Last-II
R Me PL + H,80,	2 Feblug solution
S Br Ph H AgN ,	4 HCHO NaOH

The correct uption as

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Integer Type Questions

Integer Type: The answers to each of the following question is a stugie digits integer ranging from 0 to 9,

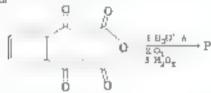
- 1. The total number of some meridebydes and ketones having the nullecular formula $C_n H_{\tau 0} O$ are
- 3. The number of compounds which undergo addition densation in the following list of compounds are methania, 2 methylpentania, cyrlohexan-1-one, bearidehyde, 1-phenylproponous, phenylacetaldehyde, 2, 2-dimetaylbutania, hemriquenum, propinione.
- 3. The number of teomeric ketones having the molecular formula $C_4H_{12}O$ which give todoform test are
- 4. The number of compounds amongst a methans benzaldebyde propanal propanous, 2,2-Dimethylpropanal 3-methylpentanal which give Cannizzaro's reaction are
- 5. The number of reagents which convert aidehyde or ketones to elkanes in the following ast are NaBH₄, NH₂NH₂, KOH₄ HI and P: H₂, Ma; Zn/Hg, HCL LaAlH₄, Pt. audified KMnO₄, alkaline KMnO₄

6. The number of compounds which donot react with Tolien's reagent in the following list to

 The number of compounds among the following which give todoform test is

- The number of compounds which are more acidic than benzon and amongst o-mitrobenzon acid, p-chlorobenzon acid, p-methoxybenzon acid, p-tollar acid, o-tollar acid, acetic acid, o-bydroxybenzon acid are
- The number of carboxylic ande which are more eader than acetic acid amongst the following are:

- 10. The number of carbon atoms to adopte and to
- 11. The number of compounds having boiling point higher than acetic acid in the following list of compounds is
 - (i) CH_CH_CH_OH
 - a) HCOOR
 - (m) C.H.COOH
 - (ω) CH,COCH,
 - v) CH₄CH₄CH₆CH₅
 - of) C_tH_tCOOH
- The total number of carboxylic acid groups in the product



:JEE Advance 9018

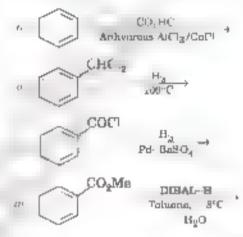
13. Consider all possible isomeric ketones, including stereoisomers of MW - 100. All these isomers are independently reacted with NaBH_a (Note: Stereoneomers) are also reacted separately). The total number of ketones that give a recemic product(s, as/are:

JEE Advance 0011

14. The cutal number of atereouspiners that can exist for Miss

(JEE Advance 2015)

 Among the following, the number of reaction (a (that produce) s) benzaldettyde ia



WEE Advance 2015)

10, 5 11 2 13, 2 18, 5 14. 2 10.



NCERT

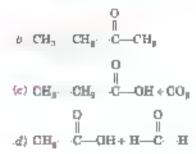
Exemplar Problems



Objective Questions



 Addition of water to allowers secure in acidic medium and in. the presence of Hg³⁺ mas as a catalyst. Which of the following products will be formed on addition of water to but-1-yes under these conditions.



(Par

2. Which of the following compounds is most reactive towards nucleophilic addition reactions?

- 8. The correct order of increasing acidic strength is
 - a Phenol « Ethanol « Chioroscetic and « Acetic and
 - .b Ethanol < Phenol < Chioroscetic acid < Acetic acid
 - .c Ethanol < Phanol < Acetic and < Chloroscetic and
 - (d' Chioroscetic soid < Acetic soid < Phenoi < Ethanol
- 4. Compound Ph. O C. Ph can be prepared by the reaction
- .c. Phenol and benzoic and in the presence of NaOH.
 - b Phenol and benzoyl chloride in the presence of pyridine
 - (c) Phenol and benzoyl chloride in the presence of ZaCl.
 - to! Phenol and benzaldehyde in the presence of pulladium
- The reogent which does not react with both, acetane and benzaldettyde
 - a. Bodium hydrogensui.plate
 - Phenyl bydrazme
 - .c) Felding's solution
 - d) Grigmard reagent
- 6. Cannizaro's reaction to not given by

7. Which product is formed when the compound

बाद्य सङ्ख 19 Highly

Structure of A and type of isomerism in the above reaction. are respectively

- (a) Prop-1-ac 2-ol metamerian
- b Proping and again tautomerism
- Proprisensial geometrical acomerant
- (d' Prop-1-en-2-ol teutomerism
- B. Compounds A and C in the following reaction are

$$\text{CH}_{3}\text{CHO} \xrightarrow{\text{CH}_{3}\text{MgBr}} A \xrightarrow{\text{hgSG}_{4,3}} B'$$

- dentined
- (& posttrone) reconno
- (c) functional isomers.
- .d) optical isomers
- 10. Which is the most stateble respect for the following conversion?

$$CH_{\bullet} \cdot CH = CH + CH_{\bullet} \cdot C \cdot CH_{\bullet} \quad \bullet$$

$$CH_{\bullet} \cdot CH = CH + CH_{\bullet} \cdot O \cdot OH$$

- a Tollem a reagent
- 55 Benzoy percande
- (c) L, and NnOH solution (c) Sn and NaOH solution.
- 11. Which of the following compounds will give butanous on modeling with alkaline KMnO_a solution?
 - (a) Butan-1-ol
- (c) Both of thesa
- d) None of these
- 19. In Clammenson Reduction carbonyl compound at treated
 - (a) Zane amaicam + HCl
 - (ā) Sodium amalgam + HCl
 - ic. Zinn amaigam a minic acid.
 - d' Sodium amalgam + HNO_a

>>>

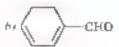
Multiple Choice Questions (Type-II)



Note: in the listouring questions two or own options may be correct

48. Which of the following compounds do not undergo sidol condensation?







0

- .4. Treatment of compound Ph. O. C. Ph with NaOH solution yields
 - a Phenol
- .6) Sodium phenoxide
- ,c Sodium benzosta
- (d) Benzophenone
- .5. Which of the following conversions can be carried out by Clemmensor Reduction?
 - Benzaldehyde into benzyl alcohor
 - 6 Oyclohezanone into cyclohezane
 - .c Benzoyl chlonde anto benzaidehyde
 - of Benzophenone into diphenyl methane.

- 16. Through which of the following reactions number of carbon atoms can be corressed in the cham?
 - a Grignard reaction
- В Свитом в геневия
- r Aido) condensation
- d HVZ reaction
- 17. Benzophenone can be obtained by
 - to Benzoyl chiomde + Benzene + AJCL
 - b, Benzoyl chlocide + Diptienyl cadmium
 - (c) Benzoyl chloride Fliengl magnesium chloride
 - (d) Beozene + Carbon manasida + ZaCi,
- 16. Which of the following is the correct representation for intermediate of nucleophilic addition reaction to the given carbonyl compound. A)

18. (b) (d)



Note Match he tems of Column and Column in he following questions

Match the common names given in Column a wide the lineA names given in Column al.

	Common names)	1		oluma II UFA(names)
18	Cimnumaldebyde		(4)	Penkuna
(6)	Acetophenone		Ç64	Prop-2-enal
(c)	Valeraidebyile		eaT)	4-Methylpent-8-en-2-one
17	Armlein		±ſ.	A-Phenylprop-2-end
16)	Mentyl oude	1	(v)	1-Phenylethenone

20. Match the scids given to Coulain , with their correct IUPAC names given in Columb II.

Column I Acids	Column II (C. PAC names)
a Phthalic and b. Justic and	 i) Herane-1.6-dvorc acid (a) Herane-1 I-diombox/lic acud
c) Successe seed	(at) Pentana 1,5-danc and
d) Adipte seid	m) Butane-1,4-dime acid
s slutame and	v Ethane-1,2-dioir and

21. Movels the repretations given in Column I with the stateble reagents given in Column II

Column I	Column II
(Reactions)	(Reagants)
a) Benzopherma - Diphenylmethane b' Benzohenma - 1-Phenylethanel c) Cyclobermone - Cyclobermod d) Phenyl benzoste -> Benzoldebyde	(a) LaAiH, (b) DIBAL—H (b) ZofHg/Com/ HC) (a) CH ₀ MgBr

22. Metch the example given in Column I with the name of the reaction in Column II

Column I Example)	/ Column II (Renotion)
о сн с сı+H, _{Басс, Вого} (н° с н	Friede' Crafte arylawon
CHO CH_OH COO*Na	n IIVZ reaction
CH ₂ C CI MO ₂	r> Audol condensation
а R— "H _e . «Сти)Н — ^{BeRed P} а R — С — СООН — Вг	· Cancusarria senstran
e CH ₂ -CN	ം Rosennucada reducuos
Λ 201H ₃ O)(0 Noble = c H ₃ , 21H = CH 1H0	Stenhen a rearbon

Note the second
Note: In the following questions a statement of assertion followed by a statement of reason is—given Choose the correct answer out of the following chairss.

- a Assertion and reason both are current and reason is correct explanation of assertion.
- 5. Assertion and reason both are wrong statements.
- Assertion is correct statement but reason is wrong statement
- Assentudo is wrong statement but reason is correct statement
- Assertion and reason both are correct statements but reaseen as not correct explanation of assertion.
- 23. Assertion Formaideliyde is a planar molecule.

Reason It contains sp³ hybridized carbon atom.

- Assertion Compounds containing -CHO group are easily exchased to corresponding carboxylic scale
 - Reason ! Carbonyle acids can be reduced to alcohols by treatment with LaAlH,
- Assertion: The α-hydrogen atom in carbonyl compounds in iees acidic
 - Reason 1 The amon formed after the lose of a-hydrogen atom is resonance statuteed.
- 26. Assertion Aromatic aldehydes and formaldshyde undergo Campizaro reaction.
 - Reason. Arminatic aidehydes are almost as reactive as formesdeliyde.
- Assertion: Aidehydes and ketones, both reset with Tollan's reagent to form alver mirror
 - Reason Both aidehydes and ketones contain a carbonyl group.

28. .a) 24. (e) 25. .d) 28. (e) 27. (d)

Hints & Explanations for

Hill terrifth

lints & Explanations Difficult Objective Type Questions

A meg with only one correct answer

- A8. b Cananzzaro's reaction is given by aldehydes wands do not contain a hydrogen. Therefore, HCHC does not give time reaction
- A7. b The compounds containing ("H₃("O) or "H₃ Ho H group give indeform test
- AB, $B = RCHO + 4H = \frac{2n^2H_0}{HCO} + R = CH_0 + H_0$ Nonmenseo variation.
- An. of The product of exemples is a single product and is symmetrical with same number of carbon atoms. It is

All b
$$HC = PH$$
 $\stackrel{Hg Si}{=} A$ $\rightarrow PH_g CH$ $\rightarrow \stackrel{GA,PI_{d}}{=} 1$ $CH_g CH_g$ $\stackrel{P \to r_{2}}{=} \rightarrow CH_g$ $)H_cBr_{1}$

Ċ

Competition File

A50. σ β-hydroxy aldehydes or β-hydroxy ketones readily undergo dehydration to give α β-unsaturated aldehydes or ketones

A44.
$$b$$
 H_a H_b H_b H_b CH_b CH

A47. c
$$COCH$$
 $COCH$ $COCH$

Anthomic medical

A48. c The carboxylar acids have higher colling points because they form essociated innecties due to H-bonding.

Vol 188. Il ac

- A50. .e) Picric and is transcriptenol and does not have narburyl group
- $\textbf{AM}(1.5) \quad \textbf{CH}_3 \, \textbf{CH}_4 \, \textbf{COOH} \qquad \overset{\textbf{P. CH}_3}{\longrightarrow} \quad \textbf{CH}_3 \, \textbf{CHCOOH} \qquad \overset{\textbf{all-Math}}{\longrightarrow} \quad \textbf{CH}_3 = \textbf{CHCOOH}$

A52. (d) Formus and gives silver nurror test while aretic and does not

A54. b CH₂ C: COOH does not contain or bydrogen and therefore, will not undergo Heil Volbaria renction

 CH_3

2 2 - Dimethylpropanole end

Alife. 5) Position (x is most audic because of -COOH group.

 NH_3 group at position y a more neither than as a bosonic of the presence of excelsion withdrawing - O(R)H group in clear proximity

B. mcq from Competitive Examinations

B3. (e) $CH_3CH_2COOH \xrightarrow{Br_3/P} CH_3 \xrightarrow{f} -COOR$

CHO +: P_MSO₄ → Ct CH

Br

DDT

B5. (d) 2 HCHO $\xrightarrow{Cape MaDM}$ HCOONs + CH_gOH There as no furnishment of C-C acod.

$$B6. (b) \xrightarrow{CH_2CH_3} \underset{ROH}{KMnO_4} \xrightarrow{KOH} \xrightarrow{COOH} \xrightarrow{C_2H_3OH} \xrightarrow{C_2H_3OH} \xrightarrow{C_2H_3OH} \xrightarrow{Br}$$

- B8. b Carbonyl group can be reduced to L²H₂ group with zing analysis and rood H²! This reaction is known as Demonsters reaction.
- 80. b CH_CHO and C_H_CH_CHO can be that inguished by iodoform test because CH_CHO will give iodoform test but C_H_CHO will not

B10. c Adebydes having no o-hydrogen atoms on beating with conc KAH 50% undergo fannizzaro a reaction.

B11. a An I effect increases. COOH group becomes more electron definent and tendency to lose H* increases and therefore, addit strength increases. Hence $CF_n \cap DH \times TC_{n_1} \cap DH \times CH_n \cap BH$. An I offect increases, and a strength decreases in $CH_n \cap H \times H$, with Thus correct order $F_n \cap D \cap H \times TC_n \cap H \times H$ and $H \times H_n \cap H$.

 Reduction in the presence of Zn/Hg and conc. HCl is used for aldehydes and ketones but carboxylic and group remains unaffected.

$$\begin{array}{c|c} CH_3 & CHO & COCL & CHO \\ \hline & (\forall i_1 \in \mathbb{N}_2) & \\ \hline & \vdots & \\ & \vdots & \\ & & \\ \end{array}$$

- B18. d Electron withdrawing group NO, facilitates the nucleophric attack
- B14. c o-Nitrophenol is a weaker and than HCO, and peace it lines not react with NaHCO₃. Therefore a-maraphenia will not be soluble in sodium hydrogen carbonate solution.
- B16. a Since the compound gives phonyl by drawing the must be an aldehyde at a ketone. For nodoform test, there must be $CH_3 C$ group and for Touen a test. THO group is required. Hence, $CH_3 C$ and CH groups are absent. It gives a specime on reduction and, therefore, it is a straight chain compound. The compound is

B17. b) All the three

In the case, a: H participates.

$$H = \bigcup_{\mathbf{C} \in \mathbf{H}^3}^{\mathbf{C} \in \mathbf{H}^3} = \bigcup_{\mathbf{C} \in \mathbf{H}^3}^{\mathbf{C} \in \mathbf{H}^3}$$

In the case, at H partiripates

III
$$\operatorname{CH}^2$$
 CH^2

In the case y H participates

rehydrogens at bridged carbon stoms donot partimpate in transmersant. Therefore, I and II wourb cantain vehydrogens at bridged carbon atoms donot show sautomerism. Only structure, III shows tomorphism.

Biff. c R: C:
$$H + R'NH_3 \rightarrow R + \dot{C} + N \cdot R' + H_9O$$
Schaffe base

l= 0 bond is reduced faster than 🚐 mind with H., PdV

5-heto-2-methylhen-4-enal

B27. b binde A gives silver mirror tost at must be an aldehyde or o-hydroxyketone

$$2NnOH + I_3$$
 $\Rightarrow NnOI + NnI + H_5O$

B20. d) Carboxylic acids have higher boiling points their aldenydes, ketones or even alcohols because of association dirough incormolecture bydrogen bonding

BSD.
$$\alpha$$
 HCHO + $CH_3 \in H$ $\xrightarrow{dis} NaDH \to H$ $\xrightarrow{O} CH_3CHO \xrightarrow{Heat} CH_3 = CH \xrightarrow{C} H$ $\xrightarrow{H_3O'} + CH_3 = CH \xrightarrow{C} A$ COOR

Bill of Electron donating groups tend to decrease and recharacter while electron withdrawing groups tend to increase writer character. The effect of substituents on acidity is more pronounced as prossument then at ne-position biorcover o-substituted neuron sciences are generally surroughrends man neurons and known as ortho effect. Thus, increase order is

B94. c
$$\Gamma_b H_b \ ^*H=0 + C_a H_b C Benzeldehyde Acetophenome NaOH $\rightarrow \Gamma_a H_b C \rightarrow \Gamma_a H_b C H = H_b C \Gamma_a H_b$

Enzeldehyde Acetophenome 1.3-Duphenylyrop-2-en-1-one$$

B35.
$$\sigma$$
 $^{3}\text{H}_{3}\text{CH}=^{3}\text{CH}_{5}$ $^{3}\text{H}_{3}$ $^{3}\text{H}_{3}$ $^{3}\text{CH}_{4}$ $^{3}\text{CH}_{5}$ 3

B36.
$$a$$
 H,C· HC—CH· CH, $\frac{C_1 \cdots C_n}{2n \times 1,0}$ $\stackrel{\bigcirc}{\longrightarrow}$ $\frac{C}{2}$ H₁C· C—H

But-2-cas

Arctaldebyde
(Molar mass = 44a)

B37. b) Stronger the end, weaker is the conjugate base

Base + Proton > Conjugate and
Conjugate acid formed will be RCOOH, NH₂, HC = OH CH₄
Acidic strength follows order
RCOOH > HC = CH > NH₅ > CH₄
Increasing basicity will be
ECOO < HC = Cf < NH₆ < Nf

B38. 4d Phenoi gives violet colour with neutral FeCl, but benzue and gives buff coloured precipitate

B41 a Since compound A molecular form the C₈H₅Br- gives a light yellow ppt when warmed with elepholic AgN₁₅, therefore. Br must be present at since them. Therefore option but which Br is present at the ring is not possible. Further since the compound Argives at and B. C₈H₆O₄ which readily forms an analyzinde on seeining, interefore, computed A must be o-disubstituted. Therefore, option to in correct

$$\textbf{B42.} \text{ at } \text{CH}_{3}\text{COMP} \xrightarrow{\text{LAMA}} \text{CH}_{3}\text{CH}_{3}\text{CH}_{4}\text{CH} \xrightarrow{\text{PCH}_{3}} \text{CH}_{3}\text{CH}_{3}\text{CH}_{3}\text{CH}_{3}\text{CH}_{4}\text{CH}_{5}$$

B46. (b DIBAL-H reduces esters and carboxylic acuts to aldebydea.

- B47. b Only aidebydes and ketones having CH₃CO—group give indefering sest. Therefore CH₃COCH₃ will react with sodium bypointile but CH₃CH₂CHO will not.
- B48, of The correct order of ender strength is a-tolar acid > became and > p-tolar and
- B49. d The compounds containing City C group or CH, (11 group undergo indofurm reaction and form indoform on

reaction with L and aqueous NaOH. Therefore, CH, CH, CH, CH, OH. CH, will give codoform sest.

- B50. (d) CH,CHO because it has a bydrogen.
- B51 & It is Memmensen's reduction.

B52. ... The mechanism for benzoin condensation is

Ph $-\dot{\underline{C}}$. -CN is the intermediate.

B53. (d) Reaction in acidic medium proceeds upto monobrommation stage

B54. $\epsilon\epsilon$ Electron withdrawing group N^{ij}_{a} present an benzon and increases the neader strength while electron releasing group $O(N_a)$ decreases the neader strength. Hence, correct order of ends; strength is $N < I < I_i < I_i$.

B55. c
$$C_6H_6COOH$$
 $\stackrel{\circ}{\sim} ^{NH_2} \rightarrow C_4H_5CCNH_2$ $\stackrel{\text{Bell B1}}{\sim} \rightarrow C_6H_5NH_2$ $\stackrel{\circ}{\sim} ^{Conc.H_2SO_4} \rightarrow C_8H_4NH_1$ (SO₂H Benzamula P) Anilhus (Q) Sulphanilhus unid R)

Bill. (a)
$$CB_3COOH + Na_2CO_3 \rightarrow CH_3COONa + H_2O + CO_3^{\dagger}$$

This compound can exact with 2.4 LNP to form its derivative and radanse Tollen's reagen, and undergree Camuzzaro's reaction.

B59. c
$$CH_{g}$$
 $C = N$ $CH_{g} CH_{g} CH_{$

It is en intra-molecidar Cannizzaro reaction.

B61. a In CCLCHO, there are three electron withdrawing chloring groups attached to a-carbin. Therefore, it undergoes hydrolysis material of Canazzaro reaction.

Butane L. S-dia

B64. (a) $\mathbb{X} = \frac{\mathbb{X}_{\mathbb{R}^{2} \times \mathbb{R}^{2}}}{\mathbb{R}^{2}} + \text{Product} \rightarrow \text{reacts with Phenyl hydroxine}$

Product formed reacts with pheny' by drazine but does not answer silver mirror test. Therefore, it must be a ketone. Retone is firmed from oxidation of secondary alcohols. Therefore, X must be 2-propagal.

OH

B85. If
$$CH_3COOH$$
 CH_3COOH annihilation $C_8H_3CO^2H_3$ $C_8H_3C_8C_8H_3C_8C_8H_3C_8C_8$

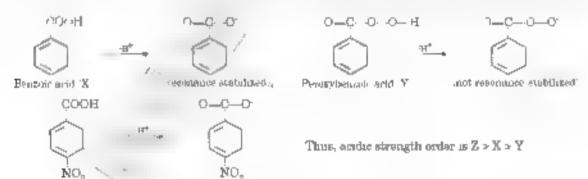
 CH_{J}

B86. b
$$= N$$
 $\xrightarrow{\text{PaNglin, TRP}}$ $C = NMgBr$ $\xrightarrow{\text{Pl}_1}$ $\xrightarrow{\text{Pl}_2}$ $\xrightarrow{\text{Pl}_3}$ $\xrightarrow{\text{Pl}_4}$ $\xrightarrow{\text{Pl}_5}$ $\xrightarrow{\text{Pl}_5$

B67. b The aldehydea which donot contain o-hydrogen undergo Camuszian is reaction

Bos. (a) Pb—CH, CH, COOH 3-Phenylpropanous seid

B70. a The andic strength depends upon the stabilization of negative charge developed on anion due to loss of H* ion.



p-ratrobensor acid Z: due to electron withdrawing nature of NO_c group

B78. (b)
$$CH_8Br \xrightarrow{\text{RCM}} {}_{\bullet}CH_3CN \xrightarrow{\text{LinO}^+} {}_{\bullet}CH_3COOH \xrightarrow{\text{LinDit}} {}_{\bullet}CH_3CH_2OH$$

A) (B) (C)
Ethyl allabati

B75. c CH₂CH₂CH₂COOH CH₂CH, CH COOH: CH₂ CH CH₂COOH: CH₃ CH₄ CH₂ COOM

But very seaso Cl Y C

2-Chlorobutyric sold S-Chlorobutyric sold 1,2-Dichlorobutyric sold (IV)

Electron withdrawing group. (1) increases the acidic strength of carboxylic and due to. I effect. The inductive effect decreases with increase in distance. Asso, greater the number of such groups, larger to be acidic strength. Thus, order of microasing acidic strength is

CI

$$I \times IH \times H \times IV$$

B76. b Since C₄H₈O gives indoform test, it should have 42—CH₂ group It can be 1H₂CH₃C CH₃ C₄H₃O.

Therefore, O₄H₃₀O(N should be OH₃OH₂OH CH₃

$$CH_{3}CH_{2}CH CH_{3} \xrightarrow{h_{3} \circ r_{3} \circ r_{3}} CH_{3} CH_{4} CH_{5} \xrightarrow{L_{2} N_{0} \circ H_{3}} CH_{5}$$

$$OH \qquad OH \qquad OH$$

$$N = \sum_{i \in \mathcal{N}_{1} \circ r_{3}} CH_{3} CH_{4} CH_{5} CH_{5} CH_{5}$$

$$CH_{3}CH_{4} \circ r_{5} CH_{5} CH_{5} CH_{5}$$

$$CH_{4} \circ r_{5} CH_{5} CH_{5} CH_{5} CH_{5} CH_{5}$$

$$CH_{5} \circ r_{5} CH_{5} CH_{5} CH_{5} CH_{5} CH_{5} CH_{5}$$

$$CH_{5} \circ r_{5} CH_{5} $

B77. In With increase in steric hindranes, the surfaces of undergo outdeophian addition reaction decreases. So correct order is

B78. $\sigma : CH_2 = CH_2$ $GH_3 = CH_4$ $GH_4 = CH_4$ $GH_4 = CH_4$ $GH_4 = CH_4$ $GH_5 = CH_5$ $GH_5 = CH_$

B79. a) The compounds having CH₂—C— or CH₃CH— undergo beloform reactions. Thus "H₃C— "H₄ undergoes nakoform reactions.

Buth Zn-Hg. HCl and NH₂NH₂, KOH can reduce "group to CH₂ group But Zn/Hg HCl will bring about substitution of OH group by Claise Therefore, most effective reagent is NH.NH₂, KOH

B81 (e) Haloform reaction is given by compounds containing

Turee aldol reactions

B91. (b.
$$CH_3CH_3COCH_1 \longrightarrow CH_3CH_2C$$
. $CH_3 \longrightarrow CH_3$ $CH_$

m anche medium, monohalogenation takes place with 1 mol of halogen-

B98. d' Phenol is weaker acid then carbonic and H₂CO₃ and does not inverse CO₂ in treatment with squeous sodium bicarbonate solution.

B96. a Architect or the effect or the entire inded benzoic acid is strongest acid among a minut p-substituted benzoic and +M effect of ∞H decreases acids strength of benzoic acid. Therefore, correct order of or id strength is I > II > IV

B97 (c) NaBH₄ in C H₅CH reduces only addressed group. It does not reduce after group. LtA1H₅ in Et₅D BH₅ in THF and Rancy No. H₆ in THF with reduce addressed group and ester group.

C. mcq with more than one correct answer

C4. b.d.

- $a = C_4H_6OH$ and C_8H_6 200H can be separated by NaHCO, only and not by NaOH.
- b C₅H₅COOH and C₈H₅ CH₂OH can be separated by onth NaHCO₅ and NaOH because in eq. NaOH and NaHCO₅. C₅H₅COOH is multiple but C₅H₅CH₂OH is insofable
- e^{-2} AH, CH, OH and CoH, OH can be separated by only NaOH and get by NaHCO,
- .d C_gH_g CH_OH and C_gH_g CH_COOH can be separated by NaOH and NaHCC, because T_gH_g CH_COOH is soluble in NaCH aq. as well as in NaHCO_g(aq.) but C_gH_g CH_gOH is not soluble.

a) The soluble to but NeOHrag.

- (c. Motecular formula of W in $G_{10}H_{10}O_4$
- \mathcal{A}^{-} V gives afferwascence on treatment with a_{ij} results NoHO t_{ij} due to evolution of O t_{ij}

C8. b. d

(a)
$$C = C H^{0}$$
 and $C H^{0}$ was identical combounds.

b H₃CH on reaction with H IN gives both dextromtewary and neverotatory products resulting in formation of recember matrixs.

of Ph CH: .CH—C—Ph Tollow → No reaction

O

Totlen's cost is given by compounds having aldebythe group and octyphosy carbonyl compounds

C10. b. c

Q andergues Camuszaro reaction but not belaform reaction.

B andergoes usloform reaction but not Canalizzaro reaction.

$$H_{*}C \longrightarrow CH^{\frac{1}{2} - \epsilon} \xrightarrow{C_{2\epsilon} - \epsilon \log d_{2\epsilon}} CH = \epsilon - \epsilon - \epsilon H_{2\epsilon}CH \epsilon$$

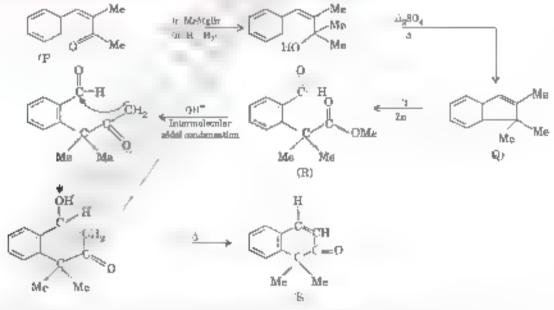
Q gives Cannizzaro reaction but not transfer in reaction.

S gives haloform reaction but not Cannizzaro reaction.

C11. (a, b, d)

D mcg based on comprehension

Di b Di, a Di, a Di, b Source P gives positive rodoform teat. It must be 2-methyl ketime



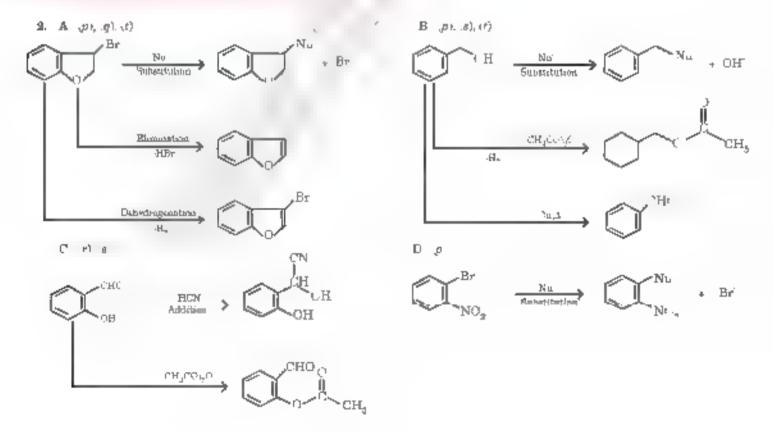
D4 *a Since J gives effervescence on treatment with NaHCO_n is should consain. COOH group. As it gives positive Baeyer's test, it should be unsaturated. J is obtained from I as

(X) and (Y) are functional isomers of each other and Y gives sudultion sest.

·S

Q to R is dehydration and R to S is Friedel Crafts acyletics.

Matrix Match Type Questions



Matching List Type Questions

Integer Type Questions

+2, 3

1. (4) Four teamers are possible

S

си,си,си,си,си,си, си сио

- Си, во

CH_CHCH_CHO. (CH_), CCHO

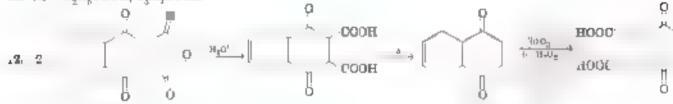
ĊH,

сньоо сньоньснь сньсоон сньо, сньсньсоснь снь

- 5 2-methylpentannil evolutions 1-one 1-phonylpropenous, phonyl acetaldehyde and propenous contain, α-hydrogen atoms and therefore anaergo additional condensation
- 8 4 CH₂COCH₂CH₂CH₃CH₃CH₃CO CHCH₄, CH₂CH₃ CH₂CO TH₂CH CH₄ and CH₂CO C CH₂ give indoform cest.
- 4. (3) Methanal, benzaldehyde, 2, 2-dimethylpropanal
- 5. (8) NH,NH, KOH, HI red P Zn/Hg, HCl
- 6. (2) Ph OH denot react with Tollen's reagent.

Competition File

- o-mitrobenzon acid p-chiorobenzon acid o-totuc acid, o-hydroxy benzon acid
- All are more ecidic than acetic scid
- .G. (6) . COOH-(CH-/a-COOH
- C_H_COOH, C,H_COOH £1. (2,



기 = 반

(5) General formula of ketoses is C_aH_a,O

Hence ketone is C_sH₄₂O

The istillers are

Only struture (ut, will not give receme mixture on reaction with NeBH,

14. (2) The compound has two chiral atoms therefore

No. of stereousomers = 22 = 4

But due to bridging, rotation is not possible and only two optical isomers are possible dextrorutatory and larvorotatory

"H CO, 3CI Gattermann Koch aldebyde synthesie anbyd AICL, /Cul7.

NCERT Exemplar Problems MCQs Type-I

1. b:
$$CH_sCH_sC = CH + H_{s^{-1}} \xrightarrow{H \to H_{s^{-2}}} CH_s \to CH_s \to CH_s \Leftrightarrow CH_sCH_sC \to CH_s$$

Phenyllhusznete

- 5. c) Febling solution does not react with acctoms and benealdshyde
- d) CH₄CHO does not undergo Cannazzaro a rescuon because it contains α-hydrogen.
- 7. 5

8. d)
$$CH_{j}$$
 $C=CH$ $\xrightarrow{\text{19-H}_{j} \cap \Omega_{j}}$ CH_{j} $C=CH_{j}$ $C=CH_{j}$ CH_{j} $C=CH_{j}$ $C=CH_{j}$

The isomenan is tautomenan-

A and 'C' are positional isomers.

NCERT Exemplar Problems , MCQs Type-II

,b), (d' In these compounds, α-hydrogen is absent.

$$2C_2H_2COC1 + (C_2H_2)_0Cd \rightarrow 2C_2H_2COC_2H_2 + CdC1,$$

Part II of the book.



for Deard Bearington

Tia	me Allowed 2 Hrs. Meanism Mea	K8 35
2	What type of bytandiastion is to volved for carbon in a carbonyl group? Arrange the following compounds in the increasing order of boiling points	<u>[1]</u>
a .	∩ H ₂ C ₂ H ₃ ∈ H ₃ CK H C ₂ H ₃ H . What is the name of one following reaction?	1
4	$RCOCI + H_0 \xrightarrow{anloyd. AUCI_0} RCHO + HOI$	(11)
	+HCN +7	1
6.	Draw the structures of hex-2-en-6-ynoic scid.	(1)
d	How will you convert the following to be izon and?	
	Ethylbenzene "Bromobenzene	2
7		
	2 Mesoylpentanni v Pheny acetaldehyde	2
В		_
	Become acid as stronger and then acetic ocid	
	. Chlorogratic and is stronger and than acetic and	2
Π		-
٩.	Ethane astrole as attache as attache p-fluorobeczaldeliyde	2
0	The No. of the Control of the Contro	
11	Explain the following reactions by giving one example :	
	Recesumend reduction a Commercure's reaction a Wolff Kishner reduc	tion 9
12.	Complete the fullowing reactions	
	$\frac{H_2D,bol}{Hydrolysis} \rightarrow C_8H_2CHO \xrightarrow{H_2MCONHNL_2}$	
	(E) CH,COCH,COOC,H, H H	(8)
19	Give one chemical test to distanguish between the following	
	Pentan-2-one and pentan-3-one the Phenol and benzoic and	
	And observed the second of the	d
		_
14	An argume compound A materials formula $C_3H_{16}O_2$ was hydrotysed with dilute sulphuric acid at give earbitryl and at electron C' . Condamon of C with chronic acid produced $B \in C$ on dehydration gives but I-see Write equation involved.	netrona for Si
] ī	FT discount of the second	
	acetanude t. acetyl chionde 22 ethyl acetate	9.
18		ogent and
	Ethernel, propanel, propanele, butanune.	
	 Authorigh p-hydroxybenzoic acid is less acidic than benzoir acid ortho hydroxybenzoir acid is about 1° times a than benzoic acid. Explain. 	eore acidar (2,1,2)



ORGANIC COMPOUNDS

(Amino, Cyano and Diazo Compounds)

Building a

 I me 	lerstand	iony Text
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Conceptud Questima

CHAPTER SUMMARY & QUICK CHAPTER ROUND UP

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- HOTS & Advance Level
 Question with Answer

REVISION EXERCISES

with Previous Years PASC 48 & Other State Boards Qs

 Hints & Answers for Revision Exercises

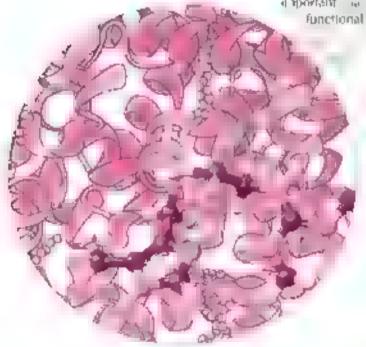
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 Hints & Explanations for Difficult Questions 1...

Notroger is iso in important constituent of many organic compounds, he apportant to test of organic compounds containing altrogen as a part of functional group are



Functional group	Class of compounds	General formula	
NH.	1) Primary aunines	RNH	
- ₹	'ir) Secondary amines	R.NH	
12	'III. Terriary amines	R_3N	
-C==N	Cyanides	RC'N	
-N = €	isocyanides	RNC	
N.	Nitro compounds	RNO	
-0: N=0	Nitrites	RONO	
As AN	Diazoonim salts	ArN. *X	

PART A

Amines are regarded as dericatives of ainmoing in which one, two or all three hydrogen atoms are replaced by alkyl or aryl group.

$$NH_3 \xrightarrow{R} RNH_3 \xrightarrow{+R} R_2NH \xrightarrow{+R} R_3N$$

 $NH_3 \xrightarrow{-R} RNH_2 \xrightarrow{\dagger R} R_2NH \xrightarrow{\dagger R} R_3N$ Ammee constitute an unportant class of organic compounds. They occur widely throughout both plants and snimals. They are found among proteins, vitamins, sikalpids, hormones etc. Synihetic examples, nolude polymers, drugs, lyests its etc. These andoes find extensive uses. For example, quining is on important anti-malarial drug, adrenatine and ephedrum are used for increasing blood pressure novacain is used as anaesthetic in dentistry coderne is used as analgesic pain killer, benadryl is used as anulinstaminic linig. Q atematy ammonium salts are used as surfactants.

CLASSIFICATION OF AMINES

CH3 NIL

Tetramethy)

ummonum, todida

The ammes are classified as primary (1°) recondary (2°) or tertiary (3°) according as one two or three hydrogen atoms of manuar a motorum are replaced by miled or a pligroups in an monta arms are. If one hydrogen atom of aminomalia replaced by askyl. R. or anyl group Ar. we get RNH, or ArNH, a primary 1° sample of two H atoms of ammonia or one to atom of bNH, is replaced by another alkyl. R. or Ar group, we get R—Nh. R. which is a 2° amine. The second a ky briaryl group may be same or afferent. Replacement of all the cares Hintonia of ammonia or another Hi atom of R—NH—R by alkyl R" or arvl group gives R—N R R" which is a "samine R may be same or different than R or R's.



(where R, R' and R" are alkyl groups).

The characteristic groups in primary secondary and tertiary amines are

MH. nmano) (tunino) terf-mktocen

Aport from these three types of ammes, there are nother class of comparada known as quaternary ammonium. compounds. These compounds may be regarded as demeatives of aminomium sales in which all the four H atoms are replaced by alkyl or aryl groups. For example,

$$\begin{bmatrix} \mathbf{R} & \mathbf{R} \\ \mathbf{R} & \mathbf{N} & \mathbf{R} \end{bmatrix} \mathbf{X}$$

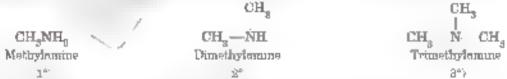
Administra satt

"₂H₂ ₂N) Cl Tetraethy) ammin im chimde Tetrealkyl ammonium salt $C_2H_2 \setminus N\Gamma^* \cap H\Gamma$

Tetraethyl mamonium hydroxide Tetrapheny) ammonton brouds

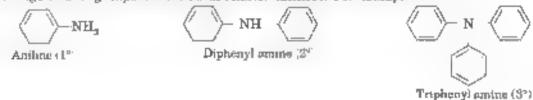
Ammes tony first, es be classifier in to two categories.

1 Alexand a amines. An is a which the caregon atom is directly bonded to one in more allege groups are called aliphatic amones. For example,



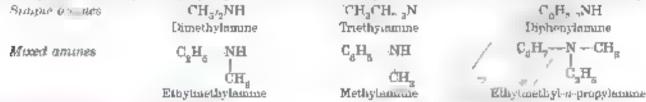
the Acometic amines. These are of two types

(a) Aryl amines. Am nes n which the nitrogen atom is directly bonded to one or more (same or different) aromatic rouge or arm groups are eated aromatic amines. For example,



(b) Arylalkyl ammes or side chain substituted ammes. Am nes in which the a trager atom is bonded to the aide chain of the aramatic ring are caused arytatkyl amines. For example,

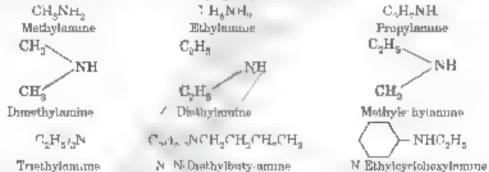
Simple and mixed amines. Secondary and terhary amines may be classified as simple or mixed amines according as all the alkyl or anyl groups attached to the introgen atom are some or different. For example,



NOMENULATURE OF AMINES

Aliphatic amines

Comp on names. According to common system, ammed are to led alkylamines by adding the stiffs amine to the name of the corresponding alkyl groups. In secondary and tentury assumes, when two or more groups are the same, the prefix d_i or b^{ij} is used before the name of alkyl group. For example



According to second system, primary amines are named as the amino - NH_o) derivatives of the corresponding hydrocarbons and are called aminoalkanes. It this system the proportion armies are named by adding the prefix amino to the name of the parent aikane our responding to the longest possible stronglishdrain.

The position of the amino group and of the substituents of any are indicated by Arabic numerals. While

numbering the chain, the carbon atom containing the amino group should get the lowest possible number

The secondary and tertiary amones are named as integer substituted primary amone is Nielky immonalkanes. While naming these the word N -a kyr or N -Niel akyr is prefixed to the word amono alkane. The prefixes N and N in near that the alkyr groups are N and or the natiogen atom rather than in the carbon atom. I may be noted that file two or three substituents are different then the largest askyl group forms the parent askane lamino alkane and the smaller askyl groups are regarded as substituents. For example

CHaNH. CHa is named as N mer y ammosthane and not as N-ethylaminomethane

3-Methyr-2-aminobutana

Note: Earlier this method was recommended by HJPAC However, according to latest HJPAC recommendations this system is used only for naming amines which have a group of higher priority than $-\Lambda_{
m H}$, group. For example

I PAC names. In the latest RIPAC system, the all phatic smines are also called alkanamines. These names. are written by replacing "e" of the name of parent alkane by sulfix "amond". For example, CH_0NH_0 may be named as methanamine Similarly.

Ethansmine Methylpropan I samme Cyclobexanomine 4. 4 Dimethylprolohexanomine Busin-2-amine In case more than the amino group is present at infferent positions in the porent chain their positions are specified by giving numbers to the carbon atom bearing NH₀ groups and suitable prefix such as d tri etc. Is attached to the amine The etter e' of the suffix of the hydrocarbon part is retained. For example,

H₀N₁ -CH₂--CH₂--NH₂ Ethane 1 %-diamute

H₂N: 4CH₁₂₅NH₂ Pentage 1 5-diagone H₀N₁ (CH₀)₆—NH₀ Resente : 0-diamete Hexamathylanethrunne)

It may be noted that in case of arally inmines, the positive of anyl group on the anglesian curbon chain is indicated. For example,

2-Methyl-3-phenylpropan-3-amine

The common and IUPAC names of a few a inhatic ammes and walkvia; her are given below

Amone		Соттов пате	ICPAC name
OH,NH, C.H,NH, OH,CH,CH,NH,		Methylamme or Ammonias; and Ethylammie or Ammolethicae n Propylamine or 1-Ammopropane	Methanemine Ethenemine Propen-1-emine
CH, CHCH,		Inogrupylamina ur & Aminopropane	Ргорам-9-аппое
cH*NHCH*		Danethylomen, e N Methylomenomethane	N Mathylmothonomme
CH ₃ CH,NHCH ₃		Etny)methylminne or Nedavsemmethene	N-Methylethananme
CH, N CH,		Transitivition of it. N. N. Diminity aminoethers	N N-Dimethylmethanning
C _s H _s N CH _s CH _s	1_	Exhyldimethylam.ne or N. N-Dimethylaminosthune	N. N. Dimethylethanamine
OH_OH ₃		Chothylmethylmmine or N. Ethyl. N. metaylam.moethane	N. Ethyl-N-methylethenemme
$\begin{bmatrix} {}_{2}\mathbf{H}_{n} & \mathbf{N} & \overset{1}{\nabla}\mathbf{H}_{2}\overset{2}{\nabla}\mathbf{H}_{2}\overset{3}{\nabla}\mathbf{H}_{2}\overset{3}{\nabla}\mathbf{H}_{3} \\ & \overset{1}{\nabla}_{n}\mathbf{H}_{n} \end{bmatrix}$		N N Diethylbutylemme	N. N-Diethylbutan z-ennae
Aratkylamines			
CH,NH,		Renzylanime or phenylanimomethane	Phenylmethenaume
CH, CH, NH		β-Phenylethylamme ar 2-Phenylammoschane	3- Phenylethanamuse

2. Aromatic ammee

In examiner aromatic ammes are called anyl amines. These are written by adding the suffix names to the name of the anyl group. The simplest amine is $^{\circ}_{\circ}H_{5}NH_{*}$ and it is known as anythine. It is also accepted I JPAC name. The other simple aromatic amines are named as aericatives of an are

In the IUPAC system, the simplest aromatic amine $l_8H_8NH_2$ is called **bonzenamine.** Ther aromatic amines are named as derivatives of benzenamine and the positions of other groups are indicated by numbers. For example,

NH.,

Вепкециина Anahoe)

NHCH.

N-Metholbenzenannase (N Methylamhne)

CH₂—N—CH₃

N. Charethylbeagengame. (N. N. Dimethylamkne)

H_sC—N—CH_sCH_s



N-Enhyl-N-mathylbenzenomine (N-Ethyl-N-methylaniline)

2-Methylbensenamine 2 Methylamiline or o Tolindine

8-Methylbensenamma

3-Methylamine or m Taimdine

4-Methy/bensanamae

a Methylanubne or p. Totudine

In IUFA, system benzenamine may also be written as oin no benzene

NH.

4-Brombeuzenauige +Bromouniline

4 Thinethylbenzenanine 2 +Dimethylaniline

2,4. (t-Tribermoberiz-parmore 2 4 6 Imbromonnume

N. N-Diethylbenzesamine ch. N. Diethy annume

It may be noted that in some cases other names such as ormip-toludine for olmip-methylantime and o/m/p-amaidine for o/m/p methoxy amline are assigned. Even N-phonyl derivative of aniline is generally called diphenylamine.

ČH,

4 Methylbenzanamine or +Methylanikae ى:Toluidine)

OCH, 4. Methricybenzennimine or 4-Mathoxyantaine (p-Anisidine)

N-Phonylbanzanamine or N. Phonylamina 'Diphenytamine

In case of poly functional groups, the anima group is considered as substitutes and the other group constitutes the principal fund ones group and is preferred in getting lowest position. The compound is named as terrivative of the principal functional group.

ен, енен,соон

3-Ашшоргорелециале

6- Ammobûtanow end

CH, CRCH, COOH

8- Ammobulanoic acid

COOH NIL,

2. 4-Diamanobeazoic acid

If, however, all the functional groups are substituent functional groups, the compound is named as a derivative of the compound containing the functional group which comes first in the alphabetical order

CH₂ NH—CH₃ CH—CH₃

N-Methyl-2-citropropanamine

In case of unsaturated animes, the amino group is given, he preference. For example,

 $CH_*CH = CHNH_*$ Prop-1 en 1-annie CH, - OF CH, NH,

Ргор-2-ен-1-виние выучаниие

IUPAC Names of Some Complicated Amines

CH_CH_CH_N C_H_ N Ethyl-N methy/propan-1 mains

CH CH, N N N-Dacthylethenamine

CaHaN' CHaraBr Trumethylpheny emmonum bromide or

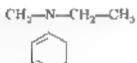
CH CH_CH_CHCH_CH_NH\'.H. CH N CH-CH.

Trimethylanılınının bromde

3-Methyr-1-1 Nomethylamino pentane or 5 Methyl .- Nome hylpenton lenning

2- N. N. Dunethylamino, butana or 24 N. N Dimetaly) botananane

4-Metisvi-A methylpentun-2-omne



CH,-CH-CH,-NH.



ŇΩ

N. Ethyl N. methylbenzenamine

2-Phonylpropan-Lamine N Benzyi-N-methylbenzenemine

14¹ի]որդաբունըցուն N Medayl penzenannie

ISOMERISM IN AMINES

Ammea exhibit the following types of isomerism.

 Chain reomerism. Alphanic amines containing four or in relative atoms show chain isomerism, due to the difference in the nature of carbon chain of alkyl groups attached to the amino group. For example,

 CH_{λ} $CH_{\lambda}CH_{\lambda}CH_{\lambda}NH_{\gamma}$ Buten-a anune

CH, CHCL, NH,

CH, C NH.

2- Methylpropens a summe

Medivipropen-2-amone

 Metamerism. This is due to difference in the primary of alkyl groups attached to the same functional group. For example

CHICH NH CHICH.

THANK THE CHATH. backbyl-a-mony-apune

CH. NH-CH CHOO Isopropylmothylamine

Diethylamine 3. Position isomerism. This is due to the afterence to position of amino group. For example,

CH_CH_CH_NH

CH, CH CH,

Propan-1-amine

NH_

Ргорад-2-авиле

Similarly.

OH, CH, CH, CH, NH, Buten-1-mane

CH, CH, CH— CH,

ŇΗ., Butan-2-amme

Aromatic amines also show position isomerism.

 CH_{a} o-Tetutdine CH.

CH, NH,

m-Totudine p-Tolundine

4. Functional learnerism. Primary, secondary and pertury amines having the same molecular formula show functional isomerism among themselves because of the nature of amino groups. For example

CH,CH,CH,NH, 4 Propylamine (41)

CH,CH,NHCH, Ethylmsthylamine (2^{n})

CH, N CH, Trimethylumine (8"

CH.

STRUCTURE OF AMINES

Amines are the derivatives of ammonia in which one or more hydrogen atoms have been replaced by alkyl or any groups. Therefore, the structures of animes are sin, at to animonia. As we know in ammonia introgen atom andergoes sp² hybridization forming four sp² hybrid orbitals. Three of these sp² hybrid orbitals overlap with s-orbital of H forming three N · H bonds. The fourth sp² hybrid orbital contains a lone pair of electrons.

The geometry of the molecule is **pyromidal** and the bond angle in ammonia molecule is 107°. Since ammes are derivative of ammonia in which one or more H along are replaced by sikyl or anyl groups, therefore, ammes are also expected to have pyromidal shape as shown below.

The rond angle in ammonia is 177. However, this to the presence of method groups in ammes, the bond angle increases. In case of 3° amme due to steric hindrance between three bulky alkyl groups, bond angle increases from 107° in ammonia to 108° trimethylamine.

OPTICAL ACTIVITY OF AMINES

The all phatic aimness have pyramidal chape with the lane pair of electrons. Since an animes, N undergoes sp³ hybridisation, the shape may be regarded as approximately tetrahedral when we assume electron pair on nitrogen as group. Therefore, the unimes containing different their users of nitrogen are chiral and we expect secondary and tertiary amines so exhibit optical activity or enautomerism. For example, methyl ethylamine the NHC₂H₄, a secondary amine or methyl ethyl propytamine to tertiary amine are dissymmetric as shown below

However analyce charal carbon compounds most charal amines cannot be resolved. This is because the two event uners forms copy by aftern very nto use another by a process called nitrogen inversion or amine inversion. This is known as flapping. This inversion which reservines on umbre is turning it at let vie it very easy and occurs very rapidly rate = 1.3 × 10.0 s. As a result of interconversion, it is very difficult to isolate a pure sample of either ethicities. It is seen observed has fluring hitrogen inversion, the state of sybridiantion of N changes from apt to spit to give a planar transition state which can either revert to the starting amine or to its enanthomer. If as above below

Anhough most simple amines cannot be resolved into enanthomers, the following types of chiral amines can be reserved.

. Amones whose chirality is due to the presence of asymmetric carbon atoms can be resolved. For example butan 3-arune can be resolved into enangomers because the 2-busyl group as clural.



Energia of buten-3-emine

? Quaternary ammonium salts with asymmetric nitrogen atoms can be resolved. The ione pair of electrons on the introgen atom is involved in introgen inversion and therefore, in a not possible to resolve the er as traineric forms. However of the lone pair of electrons on astrogen is between oil fourth, affered subsettient atversion of coafig ration is not possible. Therefore, quitientiary and to or so so existed uplical activity. For example methyl ethyl isopropy phenyl ammonium ion salts can be resolved into enantiomers as

Enantiomers of methylethyl isopropy, phenyl ammonium ion

Similarly N-oxides of tertiary amines having three different groups of R.R.R.N* also show optical activity because of the absence of a lone pair of electrons on N which causes nitrugen inversion.

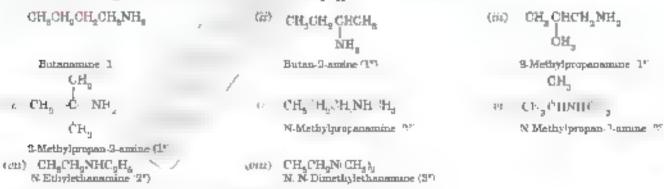
SOLVED EXAMPLES

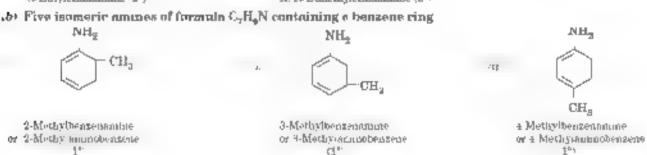
Example 1...

Drug the structures, give names according to II PAC and indicate primary secondary and technica annues (a. eight isomeric anunes of formula G, H,, N

No five isomeric anti-les of formula $C_{\sigma}H_{\sigma}N$, hat contain a beniene ring

Solution (a) Eight isomeric amines of formula C.H. N





2-Mothylbenzensamine or 2-Mostly anunobousence d"





N Merltytbensenninnie nr N-Mathylandrabensane

CH_NH.

Phenylanunomethane

Example 3.

Give the IUPAC names of the following compounds

$$CH_3$$

fau

$$\bigcirc_{NH_1}$$

(p)

NHCH,CH,

OHar NH OH. CH (A.I.S.B 30.6)

.g (CH₂ CH_{2/2} N CH₃ I S.B 2017 Br S B 2018 | Ø₄ (CH₃)₅ N CH₄CH₄ I S B 2017 № CH₅ NH Ph S B 2011 So. attun.

CH_{B}

a

пь-Тоголдина са О-Менер (Белик опишне

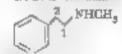
$${\rm (q)} \, \frac{{\rm CH}^2}{{\rm CH}^2} {\hspace{-0.05cm} \bigvee} - {\hspace{-0.05cm} {\rm NH}^3}$$

4 4-Dimethylcyclohesanamine

g CH,CH, N CH,CH,

 CH_a N Ethyt-N methylethilminimise

24-Benzen Fornite



N Methy(2-p'renylethanamine

CH₂ N "H₂CH₂

CH N,N-Dunethy, ethangulite NHCH,CH,

4-Ontoro-9-cata-14-cdg-anatim-

r ch, nh-ch, ch ch, ©H. Nethy⊩2 methylpropannine CH_a NH CH₂CH_a

N-Methylethanamine

Example 3...

Draw structures for the following compounds

fa, p-taxaidine

td pdluoroand ne

to. Nasopropylandine

N. Etny. 4-isopropyi N metryianiti ne

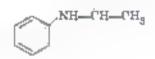
fc, t-butylamine

tf: p-tert-butyamatae

So, atton

CHa a p-toluiding

(b) N-usopropylemilma



 CH_3

(c) t-budylemine

NH2

,d) p-flugroentine

e N-Ethyl-4-mapropyl-N-methylanihoa

P p-tert-butylendine

Write IUPAC names of the following

Ans.

Buten-2-ammoe

2 9-Dmethylpropanamine

a. a-Phenylpropasamue N-Niethylethenemme

2. 6-Diammohexanoic acid.

2-Phenylpropanamine

Write the structural formula of the following and actionse primary, secondary or tertiory amuses

N-Methyl butau-2-amina

(ii) 3-N-Ethylamma) butan-1-of

N-Sthyl-N-merbytproponoscupe

en Dibenzylamme

Ans.

(a) CH, CHCH, CH, OH

Predict which of the following names are not correct?

N-Bucylethanaumoe

9º annua

a 1-Austre etherni

Methylanilme

Propanediamme

- (v) 1-Phenylethanamine
- Ans. . The larger cityl group should be considered as perent them. Thus, correct name is N-ethylbutanemine
 - OH group should get preference. Correct name is 2-minnethand.
 - If methyl is bonded to enuno N. a should be V-methylamine. If it is bonded to beczene ring, the correct name. should be a-, m- or p-taluidine or 8-, 3- or 4-methyl benzeusname
 - The position of emino groups must be mentioned. It should be . 2-proponediamine or 1.3-proponediamine.
 - c) It is correct

PREPARATION OF AMINES

The various methods for the preparation of amines are given below.

1 From Alkyl halides

(a) By ammonolysis of alkyl halides. Hoftmann's ammonolysis method. When an aqueous or almbotic solution of annuage is treated with a_{11} Brade at 378 K μ_{1} a scaled tube, all the three types of angues are obtained. In this reaction, the aiky-habdes undergo in relected by substitution reaction in which the nucleophile amnionia or amine displaces the valoges, atom. The ammonia realizable first attacks on alkyl Lande molecule to form a property arome sout. This sout their reacts with ammonia to give the corresponding primary amine and ammonium halide

The free amine can also be obtained from the ammonium sait by treatmen, with a strong base

 $RNH_{-}^{\dagger}X + NoOH$ H.O + RNH Na' X

The primary amine also acts as a nucleophile and rearts further with alkyl babde and this sequence of reactions can lead to the formation of secondary terhary and finally quadernary and man so to



The process of cleavage of the C-X roud by ammonia or amines is enfied Hoffmann's ammonolysis.

Tertury ammes also combine with methyl ladide to form quaternary ammont in saits

etramethyl ammonium iodide

The teaction is an example of nucleophilic substitution reaction is which annalogue or annue more allegants as a nucleophile due to the presence of sone pour on the autrogen and The free annues are obtained from the substituted ammonium salts by treating with ammonia.

The order of reactivity of halides as RI > RBr > RC1

Benzyl baildes also react with squeous or alcoholic solution of ammonia to from benzyl amines.

Limitations. o This method gives a mixture of amines and it is very difficult to separate the mixture in the laboratory. However, the composition of the reaction mixture depends upon the amounts of sixyl halide and aminoma taken. There are two ways of getting only one product.

- If Using large excess of ammonia. When ammonia is taken in a large excess in the reaction mixture, an a kyl hande is more akely to ear inter and react with a molecule of ammonia rather than with a molecule of ammonia which is present in relatively to the smaller impount. Therefore, only primary amme is formed as the main product.
- Att Using a large excess of alkyl halide. Under these conditions in the presence of a base which will consume HX formed, quaternary ommor unit salt is the main product.
- (b) The method is not suitable for the preparation of arviantines because anyl to itles are relatively very was reactive than alkyl holides towards nucleophilic substitution reactions.

2. Reduction of nitro compounds

About the and aromatic amines can be easily prepared by the reduction of corresponding intro compounds. The reduction can be carried out in a number of ways as discussed below

(a) No corresponds can be catalytically reduced by passing hydrogen gas in the presence of Runcy No, finish divided platinum or palladium as catalyst at room temperature

The method of reduction of

cyanide with sodium and sicoholus called Mendius

reaction

(b) Notes compounds can be reduced with active metals such as Fe. Sn. Zn et and cone hydrochore; and Red whom with iron scrap and hydrochloric and is preferred because FeCl., 6 med gets hydrochoric and hydrochoric and a median the reaction. Thus, only a small amount of hydrochieric and a median the reaction.

A mixture of SoCt, and con: HCi has also been used for the reduction of aromatic rates compounds.

This is a good method for the preparation of aromatic amines because these cannot be prepared from the corresponding anyl habides on treatment with ammonia. The required mire compounds can be easily prepared by the intration of arenes.

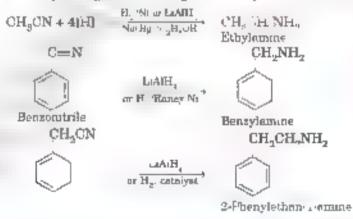
(c) Note compose its non-acto be reduced to anones us how home and a set hydrode. LtA H.,

However, reduction of arsmatic ratio compounds with LaAiH, gives are compounds and not primary amines.

$$2C_{g}H_{g}NO_{s}$$
 \rightarrow
 $C_{g}H_{g}$
 $N\Longrightarrow N$
 $C_{g}H_{g}$
Anomalies

3 Reduction of nuriles eyanides and sonifriles isocyanides

Namies can be reduced to corresponding animes using H. Raney Noor Pt. LaA.H., or NetHg., C.,H.,OH.



HELF

Synthetic Importance: This reaction is very important for **ascent of amines series**. This is because alkyl mith as can be readily prepared by the action of annhous NaCN or K. N on alkyl halides. The method can be used to prepare primary amines having one carbon more than the parent alkyl halide.

The reduction of accyangles under signast conditions gives secondary amines ze N sikyl amines.

MOTE

This method can be used only for the preparation of 2' amines in which one if the arkyl groups is always methy.

4. Reduction of amides

Anndes are reduced to the corresponding annites by LiA H_1 or No/C₅ H_5 OH. Fruitary secondary or tertiary unimes can be prepared by this method by the reduction of corresponding aimides.

mile so noticed with the productions will be stome absorber of course, when you he range on their de-

r.g
$$CH_3$$
 $CNH_2 + 4TH$ $Ether$ $CH_3CH_3NH_2 + H_3O$

Aretzinide $C_6H_5CONH_2$ $Ether$ $CH_3CH_2NH_2$

Recognise $C_6H_5CONH_2$ $Ether$ $CH_3CH_3NH_2$

Recognise

Secondary and technic amines can be prepared by the reduction of secondary and technicy animdes respectively

5. Hoffmann bromanude degradation method

Primary amines can be prepared from amides by treatment with Br. and K. H or NaCH. The amine formed conto no one carbon atom was than he parent amide. Therefore, it is method is used for stepping down the series in organic conversions.

This reaction involves the migration of alkyl group from carbonyl in the precursor to introgen with the emimation of CO_n . Therefore, the reaction provides the product containing one carbon ofon; less than the starting material.

Hoffmann Bromamide reaction

The renation is believed to proceed by the following sequence of steps

Step 1 The annie undergoes base promoted bromination to form N-bromonmide

Step 2. The N-bromonmide reacts with H ion to form an amon which rearranges spontaneously with he less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form an acceptance as a secretarial of the less of a Br ion to form a bright acceptance as a secretarial of the less of th

Step 8. The allyl isocyanate gets oydrolysed by aquenus asse to firm an annue and caromete and

$$R = N = C = O$$
 \xrightarrow{ROH} $H_{g} + K_{g} CO_{g}$
Asky cocyanate

HOTE

It may be noted that primary amines can be obtained from anudes either ω -reduction with LiA.H., or by treating with Br. and Nat. If The reduction with LiA.H., gives amine having same number of ω atoms as the origina, amide with ω excluding with NaOH and Br., gives an including one carbon in the less than the original and de-

6. Gabriel phthalimide synthesis

This method is used for preparing or y primary a sizes, in this method, phthat mide is treated with a coholic ROH to give potassium phthatmide which is treated with alkyl habde or benzy, hande to form N-alkyl or ary, phthatmide. The hydrolysis of N-alkyl phthatmide with 20% HCl under pressure or reflaming with NaOH gives product of mane.

Flathalic acid can agen, be converted into phthaminde and a useo again and again. This method is very useful because it gives pure sources.

It may be noted that the Lydro vais of N alkylphthalimide with equeous acid or base is generally alow. The more convenient method is by the freeduction of alkyl pathalimide with hydrozone. NH_gNH_a.

REMEMBER

Arys anades cannot be converted to any amines by Unbriel synthesis because they do not undergo nucleophilic substitution with potassium phthalimide. Therefore, aromatic primary amines such as antimo, toluidines etc. cannot be prepared by this method.

7 Reduction of axides

Primary ammes can be prepared from askyl habdes by first converting the askyl hande to askyl azide. Askyl azides are prepared by nucleophilic substitution of askyl mindes by sodium azide. Then askyl azides are reduced to askyl amines with sodium and alcohol or inthium aluminium bydride or by casalytic hydrogenation with H_a. Pd—C

Soften aride

RN
$$_{0}$$
 $_{0}$ $_{0}$ $_{1}$ $_{1}$ $_{2}$ $_{3}$ $_{4}$ $_{1}$ $_{2}$ $_{3}$ $_{4}$

8. By reduction of oximes

Primary annaes can be prepared by the reduction of existes of aldehydes, and ket mes with either Na/C_aH₅OH or LaAlH₁. The existes can be obtained from aldehydes and ketones by reaction with hydroxylamine.

9 Reductive ammation of aldehydes and ketones

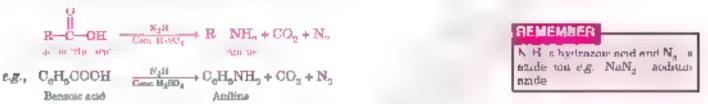
Primary snames may be prepared by reacting aniebyde or ketane with ammonia to form intermediate maines which can be reduced with H., Nr.

This reaction leading to the conversion of an aldehyde or a ketone to the corresponding amme on treatment with ammonia in the presence of a reducing agent $[H_n, N)$ is called **reductive amunition.**

It may be noted that if instead of NH_g , a primary smine is used in the above reaction, secondary smine is obtained. For example,

Similarly with secondary amines, tertiary amines are formed. For example,

16 Schemelt reaction. Carboxylic acids react with hydrazoic acid. N_gHe in the presence of cone. H_sSO_g to form primary amines with the evolution of SO_g and N_g .



Instead of conc. H_2SO_4 and N_3H_4 a maxture of NaN $_3$ and conc. $H_3 \gg 4$ can also be used.

IN JUSTRIAL PREPARATION OF AMINES

 From alcohols. In an industrial scale sliphatic amines are prepared by passing vapours of an alcohol and animoms over alumns at 723 K. This reaction is called Sa ratter and Matthe method.

The mucture of three smines is separated by fractional distillation.

3. Analine. In an industrial scale, among is prepared by the reduction of autrobenzene by catalytic hydrogenation. Ht/Pt or V or ChOs or by chemical means using Fe/H T or Sn/HC.

$$NO_{2}$$
 NH_{2}
 NO_{2}
 NH_{2}
 NH_{2}
 NO_{2}
 NO_{2}
 NH_{2}
 $NH_{$

Amine is also prepared on a large scale by treating chlorobenzene with ammonia at 473 K and 80 atm pressure using copper oxide as catalyst



ONLY BUILDING AND THE SP

J Example 4. -

Write chemical equations for the following reactions

(a) Reaction of ethanolic NH_{θ} with $C_2H_{\theta}CL$

To Ammonotysis of benzyl chloride and reaction of amine so formed with two moies of CH₃CI

☐ Example 5. _

Write chemical equations for the following conversions

(a) C_BH_ECH₀NH₀ into C_BH_ECH₀OH

(ii) C_0H_0Cl into $tC_0H_{\delta^{l_0}}N$

(iii) Propene into butylamine

(iv) repropyl bromide into ethylamine

(b) Benzene into benzylamine

So. atton

N. N. Diethylethanemme

$$\frac{\mathrm{CH_{3}CH_{3}CH_{3}Br}}{\mathrm{polytopoption}} \xrightarrow{\mathrm{dig}_{1} \mathrm{KOH}_{2}} \mathrm{CH_{3}CH_{3}OH} \xrightarrow{\mathrm{Ka}_{2} \mathrm{Cr_{2}O_{3}}} \mathrm{CH_{3}} \xrightarrow{\mathrm{H}_{3}C\mathrm{Cro}H}$$

CH₃CH₂NH₄
$$\leftarrow \frac{Hr_2}{NaOK}$$
 CH₃CH₂CH₃CH₄C NH₄ $\leftarrow \frac{Nh_3}{Nh_3}$ CH₃CH₂CO CT

$$\begin{array}{c|c} CH_2 & COOH & CONH_2 & CH_2NH_2 \\ \hline \\ CH_2Cl_3 & \hline \\ Benzene & \hline \\ Benzelene & \hline \\ \end{array}$$

PHYSICAL PROPERTIES OF AMINES

The important physical properties of amines are given below

1 Physical state and smell. Lower members of the all phatic omines family such as methylamine are gases at ordinary temperatures and have smell like ammonia. The higher members with three or more "atoms are mostly inquids having fishly smell and still higher ones are soldis. Most of the amines have impressant odour. Aromatic amines, at general are toxic. Most of the amines at pure form are colourless but as they are easily oxidised, it is become coloured the to impuritues and

atmospheric condation.

2. Bothing points. Ammes have higher bothing points than hydrocarbons of comparable molecular masses. This is due to the reason that ammes are color compounds and with the execution of tertuing and with the execution of tertuing and with the execution of tertuing and two form associated in her deed due to intermolecular hydrogen bonding between introgen of one and hydrogen of another molecule as shown alongside.

However ammes have lower borling points than those of alcohols or carboxylic acids. This is due to the reason that electronegativity of

H R H
R—N H N H N R
I. 11
H N R
H

nitrogen (8.0) is lower than that of oxygen (8.5) and therefore. O—H bonds present in alcohols and corboxylic acids are more polar than the N. H bond of ammes. As a result, the hydrogen bonds in alcohols and carboxylic acids are

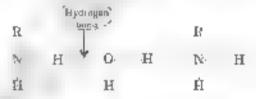
stronger and consequently they have higher boiling points. This is given below

Compound	Molar mass	b.p. (K)	Compound	Molec mass	b.p. (K)
"H _a , "H _a "H _a	44	23.	a - C_a H $_{cb}$	79	309
CH, CH, NH,	45	290	n-O ₄ H _a NH ₂	73	350.8
он оно	44	293		7.	990.3
CH_CH_OH	46	951	n-C _t H _g OH	F-4	380 3
HCOOH	48	374	a-C.H ₆ COOH	74	474.4

Among someric annaes, the intermolecular association is more in primary annies their insecondary annies. This is because in primary amines there are two hydrogen atoms available for hydrogen and furnished, while secondary annies have only one invergen atom for hydrogen bond formation. Terthery as him is he not have intermolecular association due to absence of hydrogen atom available for hydrogen bond formation. Therefore, the primary and seem lary annies have have highest boning points whereas terthery annies have lowest boning points. Thus, the order of boiling points of isomeric amines is as follows:

Primary > Secondary > Tertiary CH, CH, NH CH, CH, CH, NH, Propylamine 12 Ethylmothylamine (2) Tramethylamine 3° iap. 893 K. hp 307 K b.p. 278 K H. ANH $n \in H_0NH_n$ $C_nH_nN_iC_iH_n$ Butyl amme(1°) Dietbyl sminet2°1 Ethyldanethylamine b.p. 329.f K b.p. \$10.6 K. b.p., 850.8 K

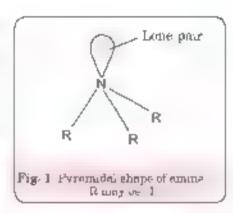
3. Solubility. The ower applicate amores are soluble in water because they are capable if forming hydrogen bands with water. However, sombling decreases with increase in malar mass of amines due to increase in size of the hydrophotic alkyl part. Therefore, the higher am destronomy six or more carbon atoms are not like. Because of their weaker hydrogen bands, the solubility of amines in water is less than that of sloubols. This is because electronogenisty of introgen is lower 3.0) than the of hygen, 3.5 and therefore, amines form weaker hydrogen bands as compared to alcohols and carbonylic acids for example button I amine is less soluble than button-I of The amines are also so table in less polar solvents, like either a notion or beazene, etc.



Aromatic animes, on the of er ... I are nothble in water This is dite to larger hydrocarbon part which tends to retard the formation of hydrogen bonds. For example unline is a soul to in water However it is quite soft bie in argains solvents such as other, also holds or benzene.

CHEMICAL PROPERTIES OF AMINES

The difference in electron agativity between nitrogen and hydrogen atoms and the presence of ione pair of electrons in the introgen atom make aimnes very reactive organic compounds. Due to the presence of ione pair of electrons on N-atom, amines sense as nucleophiles. Then imber of hydrogen atoms attached to margen atom also decide the course of reactions of amines. Therefore 1° 5° and 3° animes differ in many reactions as discussed below.



1. Reaction with water—basic character of amines

Annues have a lone pair of electrons in introgen atom. Due to the presence of lone pair on N atom of the - NH₂ group, the amines are generally basic in nature. These are more basic than water and therefore, get protonated by water to form alkyl aminomium or aryl aminomium hydrox, less which ionize to furnish. OH ions in solutions.

This reaction is similar to the reaction of sommonia with water

$$R_2NH + H_2O \rightarrow R_2NH_2^{\dagger}OH \rightleftharpoons R_2NH_2^{\dagger} + OH^{\dagger}$$

$$R_0 \ddot{N} + H_2 O \rightarrow R_0 NH^{\dagger}OH \rightleftharpoons R_3 NH^{\dagger} + OH^{\dagger}$$

P¹Amine

Into to the presence of hydroxide ions, the aqueous solutions of amines are basic in asture

The basic strength of an amme is expressed in terms of dissociation constant, K_b . For the resolution,

$$RNH_{a} + H_{a}O = RNH_{a}^{+} + OH^{-}$$

$$RNH_{a}^{+}|(OH^{-})|$$

$$RNH_{a}|(H_{a}O)|$$

Since H.Ot is constant it is convenient to a corporate it into equal in in constant as

$$K_{eq}[H_aO] = \frac{[RNH_3^+]_aOH}{RNH_2}$$
or $K_{eq}[H_aO] = K_b = \frac{[RNH_3^+]_aOH}{RNH_2}$
Thus, dissociation constant, $K_b = \frac{[RNH_3^+]_aOH}{RNH_2}$

Greater the K_k value, the stronger is the base,

The basic scrength of analysis can have be expressed a term of $ho K_p$ values which is befored as

$$pK_b = \log h_b$$

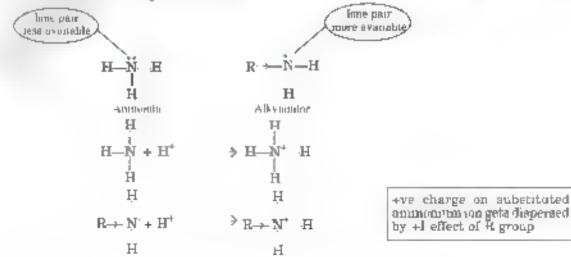
The qualter the natur of pK_{μ} more in the hade strength of mains.

Struture - Busicity Relationship of Amines Comparison of Susic Character of Amines

The basicity of any amine depends upon the ease with which it accepts a proving from the and to form the ammonium casion. In other words, the basic character of an amine depends upon the stability of the ammonium ention it forms after accepting a proton. The source while the ammonium culture is retail to the lamine, more basic is the omine.

(a) Comparison of aliphatic amuses and ammonia.

Aughout am nes are stronger bases in a ammonia. This is due to the reason that a kyl groups are electron releasing +1 and artive effect. As a result of ϵ sector, releasing effect of a kyl group, it increases the electron decisity on the mirogen atom and therefore, the ϵ can donate electron pair of electrons more easily than ammonia. Moreoverthe substituted ammonium for formed from the amine gets stabilised due to dispersal of positive charge by the +1aductive effect of the alky group $T_{\rm c}$ alkylamines are more basic than ammonia. For example, $K_{\rm c}$ value of NH_a (1.8 × 10⁻⁵) and ethylamine $(K_{\rm b} = 5.6 \times 10^{-5})$ shows that ethylamine is stronger base. The $pK_{\rm b}$ value of NH_a is 4.75 while pK_k values of animes lies in the range of 3 to 4.22



(b) Comparison of basic strength of primary secondary and tertiary anunes.

Due to the presence of ione pair of electrons in amines, they are besic in character. The sixyl group is electron releasing group. I inductive effect, and it will increase the electron density on increase and therefore, its basic character should increase. Moreover, the basic character of anyhotic similes should increase with narrease in a imberiof sikyl groups. As a result, the basic character should decrease in the order.

tertiary amine > secondary amine > primary amine.

This trend is followed in the gaseous phase

However in equeous solutions at has been observed that tertury amines are unexpectedly less hosic than the others. For example, the correct order of methylamines and ethylamines is

$$CH_a)_1NH_2 > CH_0NH_2 > (CH_a)_8N$$
 and $C_0H_8)_0N > C_0H_8NH_0$

The K, values of some ammes are given in Table 1.

Table I. Basicity constants of some amines.

Amine		K,	μK_{b}	Amode		K,	μK_b
Ammonie	VH ₃	1.5×10^{-5}	475	Aniline	NH.	4.9 × 10° 10°	86.9
Methylemine	CH,NH ₂	4.5×10^{-4}	3.58				
Dimethytomine	"H ₄ "NH	Fi.4 k] 1 ^{1 6}	3.27	N-Methy ambne	NHOH,	5.1 ± 10^{110}	08.9
Trmethylenme	CH _{4.4} N	6.6×10^{-5}	4.22				
Etbylemine	PH_OH_NH_	51×37%	3 29	N. No. or inthishooline.	- V 3H1"	I 460 × 4D →	8.00
Diethylamuse	CH,CH _{Pe} NH	10.6×10^{-4}	3.30				
Tretty-name	H ₂ H ₃₋₈ N	B 8 x 10°4	3 25	Honzy mine	TH,NH2	20×40°	4.70

This may be explained on the basis of following factors

1. Steric factor. The size of alkyl group is more than that of hydrogen and therefore, it funders the attack of acid in the amine and therefore, basic strength decreases. Now involving of alkyl group increases from primary to tertiary amines. As a result, their basic strength decreases. This is called steric hindrance. According to this effect, entury alkyl amines should be least basic.

2. Solvation of ions. When amines are dissolven in water they undergo hydration through hydrogen bonding. The substituted ammonium cations form hydrogen bonds with water molecules and release energy called hydrotion energy and therefore, get stabilised. Now, greater the extension hydrogen bonding in ammonium cations, more will be its stabilization and conservently greater will be the tendence of amine to change into cation and greater until be the strength of the corresponding amine. The stability of ammonium cation due to hydrogen bonding depends upon the number of H-stoms present on the N-stom. As can be seen telow, the hydration of protonated amine due to hydrogen bonding decreases as

$$RNH_0^+ \Rightarrow R_0NH_0^+ \Rightarrow R_0NH^+ \Rightarrow R_0NH^+$$

$$RNH_0^+ + H_0O \Rightarrow RNH_0^+ + H \text{ or } R_0^+ + H \text{ or } R_0$$

Thus, tertainly ammonium concernes typerated than secondary ammonium ion, which is less sydrated than primary ammonium ion. Thus, tertainly ammes have less tendency to form ammonium ion and consequently, they are least basic

Thus, the order of basicity of amphatic amines should be

This order is apposite to the order based on inductive effect.

As a consequence of combined effects of inductive effect and solvation. The secondary amines are the strongest bases among amines and basic strength puries as

Further when the alkyl group is small such as -CH group, there is no steme hindrance to hydrogen bonding. But in case the a kyl group is bigger than $-CH_0$ group, there will be steme his france to hydrogen bonding. This, the change of hazare of the alkyl group e.g. from $-CH_0$ to $-C_0H_0$ results in change of the order of basic strength

It may be noted that in the gas place where the solvent effect a missing the laste trend a as expected to 3°-anime > 2°-anime > 1°-anime > animome

(c) Comparison of basic strength of aromatic amines or arylamines and aliphatic amines.

Arounts' connect or arylamines are less base than alighanc annues and automore. It is example, ethylamine is been in lightnedue to the presence of time pair on N-atom. But antitine is less basic than automia as well as ethylamine as shown by R_a values.

And use
$$K_b = 4.2 \times 10^{-17}$$
 Annualize $K_b = 1.8 \times 10^{-5}$ Ethylaniae $K_b = 5.1 \times 10^{-4}$ $pK_b = 0.38$ $pK_b = 4.78$ $pK_b = 3.20$

In one or other aryl america, the NH, group is attached libertly to the herizene ring. As a result, the mahared electron pair on astrogen atom is present a conjugation with the seazene ring and becomes sees available for protonation because of resonance. Aniline may be regarded as resonance hybrid of the following resonating structures.

It is clear from the above resonating structures that three of these structures III. IV and V acquire some positive charge on aitrogen. As a result, the pair of electrons become less available for protonation. Hence, annue is less basic than ethylamine in which there is no such resonance.

This can also be understood by comparing the relative stability of aniline and anchorum ion obtained by accepting a proton. Anims in ion can have only two restorating structures.

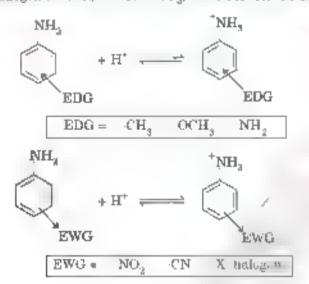
We know greater the number of resonating structures, greater is the stability. Now, we observed that whereas archive has five resonating structures, therefore an one is more stable than an initial not. In other words, and he has resser tendency to combine with a proton to form and mum ion and therefore, and he is seasons.

The basic character of amine can also be understood n, terms of orbital theory According to this concept, the orbital containing the lone pair of electrons on the introgen atom interacts with π -bonding of the beazene ring system. The delocaused π -cloud gets extended as shown in adjacent structure.

As a result, the ione pair of electrons is not readily available for protonation and therefore, aniline is less basic than ethylamine, alkyl amines).

Effect of Substituents on the Bosic Character of Aromatic Amines

Electron donating or reseasing groups size OTH₃. CH₃ increase the basic strength while electron withdrawing groups also X astogens. NO₃. CN SO₃. COOH etc decrease the basic strength



EDG * released electrons stabilized the cation and correnses basic strength

EWG - withdraws electronal destabilized the cation and decreases basic strength

For example.

The bosicity constants pK_{μ} of some aromatic onlines are given below

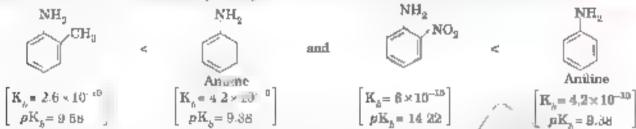
Activotan	group -		Deactivating group		
Am-ne	pK_n		Альле	ρħ _α	
p-C ₈ H ₄ CH ₃ /NH ₂	/ 8.02	1	ρ - $C_0H_4(Cl)$ NH_0	10.02	
pC.H OCH, NH,	8.60		$p \cdot C_n H_2 \cdot Br \cdot NH_n$	16.14	
potonH ₄ /NH ₂ /NH ₂	.85		p. C,H, NINH	12.28	
Anime	9.88		$\rho \cdot C_6 H_{\mathfrak{g}} \cdot NO_2 \cdot NH_0$	±3 00	

The same weakening effect of electron withdrawing group and base strengthening effect of electron releasing group as t ore marked at p-position that at q-position

Electron releasing group — CH₃ makes p-isomer more stronger basic than stricomer

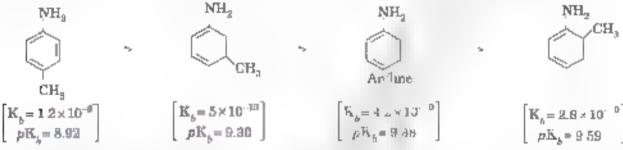
Electron withdrawing group "Not, makes presoner more weaker base than consumer.

• 1 Every o-substituted amiline electron releasing or electron withdrawing is less basic than amiline. This is due to ortho effect which is probably due to combination of steric and electronic factors.



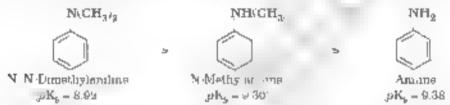
It may be noted that the base weakening effect of electron withdrawing group is very large when present at o-position than from the m- or p-position note antime and o-mire amone).

Sumilarly

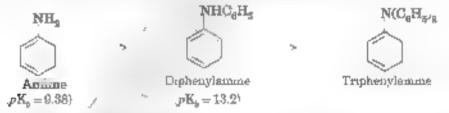


Effect of substituents on the nitrogen atom. Neubst to id andines

When hydrogen mome of the amino group of arylamines are replaced by electron donating alkyl groups, the basic character of the resulting arylamine increases. For example, N-methylamiline is a stronger base than aniline and N. M-dimethylamiline is even stronger than N-methylamiline. Thus,



On the other hand, when the hydrogen at one of among group are replaced by electron withdrawing groups, such as phenyl groups, the bear character of the resulting arylamine decreases. For example,



(d) Comparison of basic character of aralkylamines. As already learnt, the lone pair of electrons in N-atom of anime is telegrated over the reazene ring. However, in case of are kylamines, the one pair of electrons on the N-atom is not comparated with the benzene ring and therefore it is not delocalized. Hence, the ione pair of electrons on the N-atom in aralkylamines is more read- y available for protonation than that on the N-atom of an ine. Thus, the aralkylamines are more basic than arysimines. For example, benzylamine is a stronger base than animal

$$CH_2NH_2$$
 NH_2 PH_3 PH_4 PH_5 $PH_$

Further armityanianes are sets basic than allyianianes. This is because and group has electron-withdrawing aductive effect. I effect, while alky group it alky amines is electron donaining group. 4I effect. As a result, the one pair of electrons on the N-atom of araikylamines, a less easily available for protonation that that on the N-atom of arkylamines. However, they are stronger cases than aminoma. For example,

 CH_3NH_3 > $C_6H_3CH_5NH_6$ > NH_3 Mettylanime Benzylanime Ananoma $pR_6 = 3.28$ $(pR_5 = 4.70)$ $pK_6 = 4.78)$

2. Reaction with neids

Ammes being besic react with acids to form salts.

The saits of animes are ninc commounds and are soluble in water. On treatment with aqueous hydroxide, amines are regenerated.

RNH₃X + NaOH + RNH₂ + H₂O + NaX

These arrange solts are non-volatale solids and generally decompose before their melting points are reached. These are soluble in water but insoluble in non-poter solvents such as benzens, ether chloroform, etc. This difference in solubility behaviour of amines and their salts is often used to detect amines and separate, or purify, them from other non-basic impurities.

The summer react with ϵl complature acids H_2PtCl_0 to form shot bis saits called ϵl a propositionates.

The salts chloroplationates are used for the determination of equivalent and molecular masses of amines.

3. Reaction of amines with transition metal ions

Take ammonia promes combine with metal ions such as Ag^* and Ca^{24} ions to form complex compounds. The one pair of electrons in NH_3 is used to form a co-ordinate bond of amine with metal ions. For example, silver chloride classifies in metal yiannae to form a soluble silver change complex.

Similarly, copper sulphate reacts with methy mame to give deep and conjuged complex



In these completes, there is a co-ordinate bond between metal ion and amine molecules as shown below

$$\begin{bmatrix} \operatorname{CH_3H_3N} & \to \operatorname{Ag} \longleftarrow \operatorname{NH_2CH_3} \end{bmatrix} \qquad \begin{bmatrix} \operatorname{NH_2} & \operatorname{CH_3} \\ \operatorname{CH_3H_3N} & \to \overset{\circ}{\operatorname{Ch}} & \longleftarrow & \operatorname{NH_2CH_3} \\ & & & & \\ \operatorname{NH_3} & \operatorname{CH_3} \end{bmatrix}$$

4. Reaction with alkyl balides: A.kylotion

Primary and secondary amines least with alkyl halides to form tertiory animes. The primary or secondary amine acts as anticopilite and perform nucleophile substitution, along akey halide. On removal of differentially are tertiary amine is regenerated respectively. The secondary amine being a more powerful to idequate the amine reacts similarly with another alkyl halide forming tertiary amine. At each stage of the reaction, an equal energy amine at the amine making lone pair on introger not available for nucleoph the attack and therefore, shop the reaction before completion. Therefore, for the neutralisation of the acid is differentially the nucleophile, a base such as carbonate is added. Finally, the tertiary amine react with a kyl in index to form quaternary aminon in salts.

The process of converting an annue '1" 2" or 3" into its quaternary ammon um say on treatment with excess of alkyl halde is called exhaustic alkylintion.

If the alkyl halde used a methy mone, the process is commonly solied exhaustic methylation.

Aremaur amines also undergo similar reactions. For example, when stuline is treated with methyl totale under pressure, quaternary ammonium saits are formed

The letramethyl ammonium sait or quaternary ammonium habite on reaction with moist silver oxide forms tetramethyl ammonium hydroxide and silver halide gets precipitated. This on heating 400 K) decomposes to give extern amine and alcohol.

$$\begin{array}{cccc} CH_{2-q}NI & \stackrel{Mount}{Ag_{p}f} & CH_{2-q}N^{\uparrow} \cap H^{\uparrow} \\ & & \\ (CH_{3-q}N^{\uparrow} \cap H^{\uparrow}) & \stackrel{Hont}{\longrightarrow} & (CH_{2})_{0}N + CH_{0} \cap H \\ & & & \\ & & \\ & &$$

If one of the alky' groups is other than methyl, the quaternary sunnounces hydroxide, gives a tertiary anima on alkene and water on heating. For example,

$$\begin{bmatrix} \mathbf{C}\mathbf{H}_{3} \\ \mathbf{H}_{3}\mathbf{C} - \mathbf{N} & \mathbf{C}_{2}\mathbf{H}_{5} \\ \mathbf{C}\mathbf{H}_{3} \end{bmatrix} \overset{\mathbf{C}\mathbf{H}_{5}}{\overset{\mathbf{R}ont}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}}\overset{\mathbf{C}}{\overset{\mathbf{C}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}{\overset{\mathbf{C}}}}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}}}}}}{\overset{\mathbf{C}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}}}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{C}}}}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}}}}}{\overset{\mathbf{C}}{\overset{\mathbf{C}}{\overset{C}}}}}}}{\overset{\mathbf{C}}}}}{\overset{\mathbf{C}}}}}{\overset{\mathbf{C}}{\overset{C}}}{\overset{C}}}}}}}{\overset{\mathbf{C}}{\overset{C}}{\overset{C}}}}}}{\overset{C}}{\overset{C}}}}}{\overset{C}}{$$

This pyrolysis of quaternary ammonium hydroxide to give alkenes is called **Hoffmann's elimination reaction**. This can be used for the elimidation of the structure of simples.

5. Acylation (reaction with acid chlorides and acid anhydrides)

Aliphatic and aromatic primary and secondary amines, which contain replaceable Lydrogen atoms, react with each

chloride and anhydride and esters to form substituted amides. The process of introducting an own group R = C into a numerate scalard neglection. The reaction may be considered as the repairment of hydrogen atom of NH_{γ} or N is group by the acvergroup. It is nucleophilic substitution reaction. The reaction is carried on, in the presence of a mass stronger than summe are pyritime which removes HC_{γ} at force, and suits the equilibrium to the right hand side. For example,

The reaction occurs as

During the reaction, the and generated can form sail of the amine which will then lose nucleophilic character and therefore, the reaction will not go to completion. Therefore, a base is added to facilitate the reaction by the alkylation, the coulde formed does not react further with organic ballide because amide is non-basic. The lone pair of electrons on introgen is in conjugation with carbonyl group and therefore, it is a poor nucleophile.

Amongst the acid derivatives the acid charities are stronger acylating agents than the analydrides and esters which react very alowly

Since tertiary amines do not contain reptaceable hydrogen atom, they do not react with acetyl chiande. Therefore, in arginition reaction of an amine in addition to its nucleop, the character, the presence of an H atom on introgen is also necessary. Any auton can also take place with acid anhydride.

$$\begin{array}{c} C_2H_5-NH_2+CH_4CO_{12}O \\ Ethensmins & Accette \\ anhydride \\ \end{array} \rightarrow \begin{array}{c} CH_5-C-N \\ C_4H_5+CH_3COOH \\ \end{array}$$

Anome or beazenanche reacts in a sum or manner. However, acylotrop of aromatic armaes, a usually carried but in the presence of a base stronger than the amine such as aqueous Nac-H or pyridize. This base removes HCI formed.

6. Benzoylation

Abbligger and groungting animes react with bears violation to the presence of a base such as pyriting or at group NaOH to form senzoyl persyntives in which CaHaCO- is up as attributed. This reaction is called benzoylation.

Ben, cytation, of compounds containing an active hydrogen such as alcohols, phenois or amines with benzoytchtoride in the presence of dirute aqueous Nobile saucton is called Schotten Boumann reaction.

7 Sebiff's base formation recently with a debytes and get mes.

Both amphane and aromatic primary ammes react with "behydes and ketones to form amnes also called Schiff's bases or arula

Benzaklebyde Benzal antline or Benzylulene antline Schriff's base

Schiff's base on reduction gives secondary amine.

$$\begin{array}{cccc} \mathrm{CH_3CH_6N} = \mathrm{CHCH_4} & \xrightarrow{\mathrm{H_2-Hance-M}} & \mathrm{CH_3CH_6NHCH_4CH_5} \\ & \mathrm{Ethylocenecthynamine} & & \mathrm{Diethylamine} \\ \mathrm{C_6H_6N} = \mathrm{CH-} & _{0}\mathrm{H_6} + \mathrm{H}. & \xrightarrow{\mathrm{Rance-M}} & \mathrm{C_6H_6NH} & \mathrm{CH_6} & \mathrm{C_6H_5} \\ & & & \mathrm{N-Henzylamine} \\ & & & \mathrm{Secondary amine} \end{array}$$

Therefore, this method can be used to prepare ascondary amines.

Aldehydes and ketones which have supha hydrogen react with secondary amines both scyrlic e.g. N N dimethy amine as well as cyclic e.g. pyrrolidene, piperidine e.c. to form carbinolanines. These carbinolanines are unatable and readily lose a molecule of water to form stable α, β-unsuturated amines commonly called enumines ena e + ninima = anamimal.

It may be noted that the enablem in a shifted in the forward brection by removing water as an azeotrope with benzene Thus, enamine formation is usually carried out by refluxing the benzene solution of an aldehyde or kerone with a secondary amme in the presence of irac-timoont of an acid such as PTS part here suphana and

Enamines can also be reduced by catalytic hydrogenation. Ni/Ho, or softum borohydride. NaBH., to form

N. N. Domethylprop-1-en-2-amina

N. N Dimethyl-2-propanamine

B. React on with chieroform. On tall-mine reaction, or sucyanide test

Almoratic and arom, the primary america wher warmed with chieroform and an alconolic solution of KOH form soryanide or carbylamine which have very unpleasant or foul smell

Secondary and tertury amines do not give this test. Therefore, this test can be used to distinguish between primary unines from econdary and tertiary animes.

6. React n with a consuced

Natrops and HNO, as an instable and therefore, it must be freshly prepared in situ, by treatment of sodium. mitrite with cold dilute HCl or H.SO.

Note we are a source of electrophilic not resonant on $O = N^*$ which reacts with amines

Different classes of animes react differently with intrins and. This reaction serves as an important reaction to distinguish between primary, secondary and tertary amines

 Primary amines. Primary aliphanc amines react rapidly with mirrous acid to form aliphanc disconium asia. which is unstable and decomposes to give alrohol and evolve nitrogen.

$$\frac{RNH_{2}}{P_{2}^{n}(r) \cdot r^{2} \cdot r^{n}} + \frac{HNO_{n}}{HNO_{n}} \cdot \frac{N_{n}NO_{g}}{HCl} + (R-N_{g}^{+}Cl^{-}) \cdot \frac{H_{2}O_{s}}{Alc} \cdot ROH_{s} + HCl + N_{n}$$

P.
$$g$$
 HO N O + $C_2H_5OH + N_7 + H_3O$ C_2H_5 N H_2

Primary aromatic amones react with natrons and us the cold 273-278 K to form disconnum eaths. The process of formation of disconnum saids by the reaction of aromatic amone compound and natrons acid is called disconsation. For example.

However of the temperature is more than 278 K, aromatic amores form phenowell the evolution of Negas

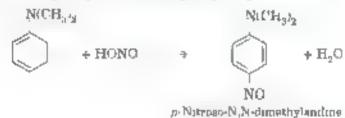
Antime . Phagot

(7) Secondary amines. Secondary sisplicate and aromatic amines react with natrone acid clowly in the cold to form yellow only nitroso amines.

The vellow only introsomme gives a green solution when warmed with phenol and cone sulphane and. On dilution with water the colour changes tilred, but it changes to greenish blue to violet on the addition of sodium hydroude. The overall reaction is raised Libermann's national reaction. This test is used for secondary amines.

(111 Tertrary amines. Tertiary amines dissolve in cold mitrous said to form asi a which decompose on warming to nitrosoamine and alcohol.

Arometic tertiary animes react with introduced to give consumed substituted introduced compound. These undergo electropialic substitution of incresons and in $N=0^{\circ}$) at the para position of the phenyl ring.



R U Garious...



- Cigarette smak ng is injurious to health. Do you know why?
- in addition to meetine eigerette smoke contains Noncrestdimethylamine which is a powerful coronoger and very harmful.

10. Reaction with aryl sulphonyl chloride

Benzene sulphonyl chloride $\mathbb{N}_{k}\mathbb{N}_{k}\mathbb{N} \mathbb{N}_{k}$ which is also known as **Hinsberg's reagent** reacts with primary and secondary amines to form sulphonomides.

. Primary amines react with benzene sulphonyl chloride to give N-alkyl benzene sulphonamide

Benzenesulphonylchionde

N-Adkylbenzeneaulphonamide

(Boluble to alkan)

The hydrogen attached to introgen in sulphonomide is strongly act or one to the presence of strongly electron withdrawing sulphonyl group. Therefore, in its soluble in adiable in adiable in a sulphonyl group. Therefore, in its soluble in adiable in a sulphonyl group.

Soluble in alkalo

Secondary amines react with benzene sulphony' chloride to form N. N-dialky, benzene sulphonamide.

Since the supronamide does not contain any hydrogen atom attached to untrogen atom, so it is not under Hence it is not soluble in alkali. KOH_{\pm}

N. N. Diethylbenzenesurjammande (Insoluble in KOH)

Tertary ammes do not react with between suiphonyletdonde.

Since different aimines react differently with benzene sulphonyl chloride, this reaction one he used for the distinction between 1°, 2° and 3° amines and also for the separation of their mixtures.

However, these days, her zene sulphory' chronide has been replaced by pitotalenesu priority' chronide

11. Reaction with Grignard reagent

Primary and secondary amines react with Grignard reagents to form attaches

HOTE

it may be noted that alkane is obtained from the alky- part of Gognard reagent For example,

Diethyl amine Ethyl megnasium bromide

Tertiary supports ammes do not react with Grignard reagen, because they do not have hydrogen atom attached to the introgen atom

12. Reaction with carbon disulphide

Primary amines react with carbon distriphide to form diffuse kyl carbonic some which decompose or heating with increase choose HgC...) to give alky isoth occanates. These have clear stends a sine, like in istard in. For example,

This reaction is called Hoffmann mustard oil yes used as a feet for primary amines.

However, aromatic annines react in slightly different ranner. For example, when annine is beauted with ethanolic CS, and soud KOH, it forms N. N. diphenyl thioures which in treatment with cone. HCl gives phenyl isothioryanate.

N, N. Drynenyl thenures, or thus rebundide, is used as an accelerator during videan sation of rubber

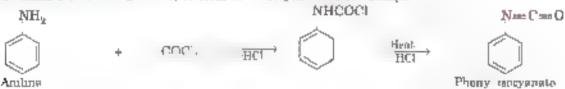
18. Reaction with carbonyl chloride (phosgene)

Primary and secondary at phase amines react with carbonyl chloride to form substituted areas.



Tertiary aliphatic animes form sults.

Aroundte 1º ammes cent with COCL to form and second ste. For example,





14. Oxidation

Oxidation of animes give different products depending upon the nature of anime and oxidising agent. Animes undergo oxidation by powerful oxidising agents such as Carres and H_2SO_3 —potassium permanganate «KMn O_4 —rydrogen peroxide H_2O_2 etc. The products of oxidation depend—poin the nature of anime and oxidising agent. For example,

(a) Oxidation of primary amines

Primary airphatic amines on undation with potassium permanganate give ratro compounds through a sequence
of reactions as shown below

Depending upon the nature of the oxidising agent, various products such as hydroxy amine introso or nitro compounds can be isolated.

Primary annues in which "NH, group is attached to the tertiary carbon arom carried endused with KMnO₄ to the corresponding nitro compound in excellent yield (about 83%).

? Primary amines react with Caro's said $H_aS\cup_{g_a}$ or H_a . In the following ways

(b) Oxidation of secondary ammes

Secondary aliphatic amines on oxidation with potassium permanganate give tetro alky, hydrazines

Secondary animes well Caro's and give corresponding N-hydroxy anime

(c) Omdation of tertuary amines

Tertiary against are not variated by KMa \cap_a at are established by Caro's and exone or H.O. to correspond ag N-exides, $R_a N \xrightarrow{C_b \text{ or } H_a G_b} R_a N \longrightarrow O$ Among N-exide

Amn

(d) Oxidation of aromatic amines

Aroman amines, because of high electron density on the beazene ring, are readily midsed on exposure to air or oxidizing agents forming a complex coloured product

$$C_nH_nNH_n+K_nCr_nO_n+H_nSO_4$$
 A black product caller aniline black

However, controlled oxidation of an one with K,Cr,O, and H,SO,, gives p-benzoquinone

15. Ring substitution in aromatic amines

Aromatic amines give the aromatic substitution reactions as given by benzene. Animale is more reactive than benzene. The presence of a mine group activates the aromatic ring and directs the accounting group preferring to arthough para positions. This is clear from the following resonating structures in which electron density is more at orthough para positions, structures III to IVI.

Therefore, substitution mainly occurs at ortho and pair memors. The to strong activating effect of NH₂₁ aromatic amines undergo electrophilic substitution reactions readily. Therefore, it is difficult to stop the reaction to monosubstitution stage. However, in order to stop the reaction to monosubstitution stage, the activating effect of the amino group has to be reduced. This can be done in manufaction with accurs an hydride in the presence of pyridine. Acetyl group is electron withdrawing group and therefore, the electron pair of N-atom is withdrawn towards the curbonyl group as shown by the following remeating structures.

Therefore the tone pair of electrons on notrogen is less available and the activating power of NH, group is decreased. This method is called the protection of the mand group by acetylation and can be used to control the rate of electrophilic substitution results in This use prevents the formation of the anti-the substitution results in This use prevents the formation of the anti-the substituted products.

The acety' group is then removed in hydrolysis to get back the anime

Some of these reactions are given below

(1) Halogenation. An line reacts which broming water readily to give a white precipitate of 2-4, 6-tribromonn.line.

However, I monosubstituted derivative is desired, anime is first acetylated with acetyl chioride and then hologenetic is carried out. After halogenetics, the acetyl group is removed by hydrolysis and only mon substituted halogen derivative is obtained.

It may be noted that NH, group directs the attacking group at ϕ and ρ positions and therefore, both ϕ and ρ -derivatives are obtained.

As a ready explained a cetylation deactivates the ring and controls the reaction to monosubstitution stage only. Git Nitration. Aromatic amines cannot be intrated breefly because they are readily expliced. This is betal set HN τ_3 is a strong exidising agent and results in partial exidation of the ring to form a black mass. However, under controlled conditions, intration of amiline gives unexpectedly 47% in intro aniline in addition to σ and ρ -nitroaniline.

The reason for the formation of large amount of a introduction is that under strongly acidic conditions and he gets protonated to an invanision. NH₃* group. The is deactivating group and a metald recting. Therefore, to some his problem intration is carried but by priceting the NH₃ group by acetylation. The acceptation deact rades the ring and therefore concrets the rank in when it expansions. The hydrogens of automacetamindes removes the protecting anyl group and gives back amines.

100) Sulphonation. Sulphonation of an one is corned out by heating anime with sulphuric und. The product formed is anilmum, lydrogen sulphote which on heating gives sulphonair and

The sulphaniar and exists as a dipolar in structure II which has an braind same groups in the same molecule. Such ions are called **Zwitter ions or inner solls.**

HOTE

Assiste does not undergo Friedel Preft reaction alkylation and aretylation because of the sait formation with aluminium chioride. Lewis acid which is used as a retallyst?

Natrogen of annine against positive charge and hence acts as a strong electron with rawing group. As a rest to the deep the electron pensity if the benzene ring and there were in tryates it. Hence, and the mess not undergo Friedel-Crafts alkylation or acylation reaction.

18. Coupling with diagonium salts

Aromatic amines react with diazonium salts to form azo compounds in acidic medium called dyes. The reaction is known as compling or diazo reaction. For example, an one contract benzene diazon: in other letto form diazonium benzene which instructed changes to psumme azo reazone in warrang with a small quantity of hydrochloric and.

Wellow dyer

Tests for amines

- 1 Solubility test: All ammeetare make in nature and hence are soluble in di. HCl. These ammes can be regenerated from acidic medium by adding excess of alkali.
- 2 Carbylamor test: Propary and as apphalic or arometic can be detected easily by hearing the amine with charoform and alkali, when characteristic four enell of isocyanides is produced. This test is called carbylamine lest. Reaction 8.
- 8 Liebermann's nitroso test Secondary amines aliphatic or aromatic can be detected by Lieberm units nitroso reaction, reaction 9)
 - Dye test. Aromatic primary amines give azo dye test reaction 16).

Uses of ammes

The important uses of aliphatic and aromatic amines are given below

- Aliphatic ammes of low morecular mass are used as solvents.
- 2 Ammes are also used as intermediates in drug manufacture and as reagents in organic synthesis.
- S Aromatic ammes are used for the manufacture of projects, dyes and as intermediates for additives in the rubber industry
 - 4 The guavernary ammunium salts derived from long chain apphatic tertiary annues are widely used as detergents.
- 5 Aromatic amines are converted into arene diazons im sails which are used for the preparation of variety of aromatic compounds via substitution and coupling reactions.

DISTINCTION BETWEEN FRIMARY SECONDARY AND TERTIARY AMINES

The following tests can be used to distinguish between primary secondary and tertiary amines

1 Carbylamine test. Both aromatic and all phalic primary amines on heating with chloroform in the presence of alcohom KOH form carbylamines or isocyanides having extremely impleasant smed. This test is called earbylamine test and is used to distinguish primary amines from secondary and tertiary amines, see resolvin 8, page 28.

- Reaction with nitrous soid. The three types of amines react differently with nitrous and reaction 9 page 1490-140.
- 8. Hensberg's test for amones. This test is used to histograph primary, secondary and termary names. In this test the amone is heated with benzene sulphonyl chionde ${}_{0}H_{6}SO_{2}C_{1}$ known as **Hinsberg's rengent** in the presence of excess of alkali. Lifferent amones give different observations reaction 10)
 - Frimary ammes give clear solution which on an infaction yields an insoluble material.
 - * Secondary amines give an ansombte substance which remains unaffected on addition of soid.
 - Tertiary amines do not react and remain insoluble in alkali and can be dissolved in acids.
- **4. Azo dye test.** Aromatic primary amines can be distinguished from aliphatic primary amines by the distinguished from aliphatic primary amines by the distribution of this test dissolve the primary amine in dil. Help and cool it to 275–278 K. Treat this solution with ice cold solution of HNO. NaNO. + dil. Help at 273–278 K. Add the resulting solution to cold alkaline solution of 2-maphthol. Branchthol. Appearance of an image or red dye confirms the intesence of a limitary aromatic amine.

The above lests are summarized below

	Characteristic Resotion	Primary	Secondary	Tertiory
1	Account which there as end NANO, + HCI	N is given due with the formation of alcohols ENH. + HON + NoT + alcohols	N trisoam nes are firmed work give a berntonn's Netrosoles. H NH + HONO R N N=0 + H ₀ O R Naresosiame	They remain dissolved forming amino natrice and warming to decomposes on warming to autroscenimes and slookel R_N + HONO + R_NHNO_ Warm R_NNO + ROH
1	Carbylamine reaction i.e. with CHCl _s and alcoholic KOH	Give futl amelling curbylamine RNH ₂ + CHCl ₂ + SKOH RNC + SKCl + SH ₂ O	No reaction	No reaction
S.	Acylotico a, reaction with acetyl chloride	Form amphas RC (NH,R	Form amides RCON K	Nr resultion
4	Hinsberg a test	Cave clear solution which on acidification gives insoluble material RNH ₂ + C ₆ H ₆ SO ₂ Cl + H C ₈ H ₂ SO ₂ NB EARL R C ₄ H ₅ SO ₂ N K ⁺ R teolyble in alkuli	Give neolub e eubetance which is ant effected by ead R.MH + C.H.SO.CI KOH R C.H.SO.N-R (Insoluble in climb)	Dues not reset.
Б	Azo dye test	Primary acoustic account give coloured dyes.	No reaction	No resetion

SOUL MEDIE X 9 WELLES

■ Example 6. =

Give the structures of A, B and C in the following reactions

$$\{i, CH_gB_T \xrightarrow{BiT!} A \xrightarrow{fakiB_g} B \xrightarrow{RNO_g} C$$

(iii) $CH_3CN = \frac{H_2O(\Omega R)}{4}$, $A = \frac{RH_2}{A}$, $B = \frac{H_3 + KUN}{4}$, C

D.S.B 2013 2014)

(A.I.S.B. 2014)

Solutions

Example 7 =

Write structures and IUPAC names of

. The anide which gives propanamine by Hoffmann bromamide reachon

N.CERT

is the alky, halide used in Garbriel pithanimide synthesis in give ethanamine

Gitt amine obtained by reduction of propanamide

to the an ne produced by the Hoffmann, argratio are if to a unital

N.C.E.R.T.

Sei atton — Since propanamine contains 3 carbon atoms — e unide molecule in 1st contain four carbon atoms.

Ethananous will be obtained by creating one potential in phthalmode salt with promoethane ethyl branishe. "H₃" -CH_Br

Example 8. .

Complete the following reachans

$$d = \bigcap_{NH_0}^{O} R_{0H} \stackrel{R_{0H}}{\longrightarrow} A \qquad \stackrel{CHCl_0}{\longrightarrow} R_{0H} \stackrel{R_{0H}}{\longrightarrow} B$$

J Example 9...

for How will you consert an allot habde into a primary am, as no ring increase maken atom, than the alker habde uses b. How can a carboxylic acid be converted. πίο an air no having one more carbon atom than the carboxylic acid used? So, after the By heating with KCN louwed by estiment with Na. C_nH_n .H. For example.

$$O_0H_0OI$$
 \xrightarrow{KCN} O_2H_0ON $\xrightarrow{Na. C_2H_0OH}$ $O_0H_0OH_2NH_2$

5. By forming amide which on reacting with Br., and KOH gives arrane baying one carbon from less.

→ Example 10. ■

Complete the following reactions:

NH.

(A.I.S. B 2018)

Nageland S.B. 2018.

$$O(1)$$
 $O(1)$
 Nogaland S B 2018

Solution

$$\begin{array}{c|c} NH_2 & NHCOCH_3 \\ \hline (i) & Pyridized & \\ \hline (iii) & SO_2CI & (CH_3 \cdot _2NH \\ \hline \end{array} \\ \begin{array}{c|c} NHCOCH_3 \\ \hline \end{array}$$

N.N. Dimethylbenzenezulphonamide

☐ Example 11. —

How will you convert the following

Solution

DISTINCTION BETWEEN PAIRS OF COMPOUNDS

1. Ethylamine and Anthre

Azo dye test. Dissolve the compound in conc. HCl and add rescoid solution of HNO₂ NaNO₃ + dd. HCl) as 273 h and then treat it with an alkaline cold solution of 2-naphthol. Appearance of brilliant orange or red dye indicates aromatic smarle i.e. are the

Aliphatic amines is ethylamine does not form dye. It will give brisk effervescence due to the evolution of N but solution remains clear

2. Ethylamine (CHaCHaNHa) and Diethylamine

Of Curbylamine test. When heated with an alcohom solution of KOH and CHC's ethylamine gives foul smelling ethyl accepanide.

$$\begin{array}{ccc} \mathrm{CH_{0}CH_{2}NH_{2}+CHCl_{8}+3KOH} & \Rightarrow & \mathrm{CH_{0}CH_{2}NC+3KCl+3H_{2}O} \\ & & & \mathrm{Foot smeT} \end{array}$$

Diethylamine does not give this test.

$$(CH_8CH_9)_2NH$$
 $\xrightarrow{C^{12}C_9AcO9}$ No reaction.

(ii) **Hinsberg's test.** When treated with **Hinsberg's reagent** between sulphonyl chloride $\mathbb{F}_8H_8S\cup (Cl)$ ethylamine gives Nethyl benzene sulphonamide which is strable in aqueous KOH solution.

$$C_6H_6SO_aC' + CH_3CH_aNH_9 \xrightarrow{AC_9} C_6H_6SO_aNHCH_3CH_9 \xrightarrow{AC_9} C_8H_6SO_aNKCH_aCH_9 + H.O.$$
Soloble to eq. KOH

Dethylamine gives N. N-diethylbenzene sulphonamide which is insoluble to aqueous $K \cup H$

$$C_0H_3SC_0G_1+(CH_3)H_4$$
, NH \xrightarrow{BG} $C_0H_3SO_2N(CH_3)G_9$ + HC1 N. N-Diethyl benzene sulphonsonde magfuble in an. KOH

3. And me and N-ethylaniline

Amiline is a primary amine. Therefore, it gives corby similar test. When nested with an alcoholic solution of KCH and CHC_{4n} it gives offensive small of phenylisocyanide.

But Niethyl and he is a secondary amore and hence does not give carbylamore test.

4. N-Methylpcopane-2-amine and N-Ethyl N-methylethanamine

Numethylpropone-2-amine is a secondary amine. On adoing Hillweeg's reagent, compound formed is insoluble in equeous NaOH.

But Niethyl-Namethyletha namme opes not reout with Hinsberg's reagent

5. Anfine and Benzylamme

Aze dye test On treatment with morous at U N·ND, + dil HCl at 279-278 K followed by reaction with an alkanne solution of β-napathou anime gives trouge red coloured dye

PART B

DIAZUNIUM SALTS

The discounting salts were discovered by John Peter Gress, a 1858. These have the general form in ArN_*X , where X may be an amontuke J. Br. AS_{-a} , BF_a , atc and the group N_* , $N := N^+$ is called discounting group or disco group. These are obtained when aromatic primary among react with natrous and.

NOMENULATURE

The discourant sails are named by suffixing the word discourant to the name of the parent aromatic compound to which they are resided followed by the name of the amon. For example,

The Bazomum salt any coman other amons also such as NO, HSO, BF, in

$$CH_0$$
 \longrightarrow $N^* = NHSO_4$ O_*N \longrightarrow $N = *NBF_4$
 $p \cdot N$ crobeutents/nezonium fluoroborate

PREPARATION OF DIAZONIUM SALTS

Aremaur, hazons an salts are prepared by reating an ice cold solution of including primary amine in excess of mineral acid ake HC or H_*SU_4 with an ice cold solution of sodium nitrice dissolved in water. The temperature is maintained between 279–278 K because most of the discontinuous salts becomplise at higher temperature.

The diazonium salt so formed remains in the solution. Since the diazonium salts are asstable and explosive substances, they are not isolated in solid form but are used directly in the solution.

$$NaNO_2 + HCI \rightarrow NaCI + HONO$$

$$ArNH_2 \xrightarrow{MaNO_2} Ar N^{\dagger} = NCI + NaCI + H_2O$$
Aromanic amine

For example, benzene diszonium chloride is prepared by treating an ice-cold solution of aniline in hydrochloric acid with an ice-cold solution of solution intrate at a io a fight. The reaction of converting aromatic primary amine to dissonium salt is called dissolvation.

Diazotesat on of amines

The vazotisation of aranes a scheered is never by the following mechanism. Narrous and formed by the reaction of sodium mitrite and mineral sold, takes up a proton from the and and undergoes beterotysis to form introsomium ton

The electrophics astrosom in ion reacts with the introger of the aims e and compares with the ione loans of electrons at N to form N in m so derivative, which by protonic shift rearranges to thezonythoxine

The dissolved condition of the solution takes up a proton and by the channel of water molecule forms dissolved in which may take η and through X to form the solution g x

Stability of Diazonium sait

Aromaun chozoni in salts are stable for to the disperso, if positive charge over the betizene might show below

R U Curious...



Are primary alsohatic diazonium salts formed ?

 Primary aliphatic discoming saits are highly unstable alkane discoming saits. These readily decompose even a low temperature. 27 i- 278 h. forming carbocation and artriges gas.

$$R + N' = NX$$
 $\xrightarrow{Oecompose}$ $R' + N + X$

Why is it important to keep the temperature very low (278–378 K) during the formation of diazonsum solts ?

➤ Aromatic diazomum salts are formed only in re-cold solution (073-278 K. However, if temperature is more than 278 K ammes form phenol with the evolution of N_s gas.

$$NH_{2} + H_{2}Nc^{-3}NK \rightarrow OH + N + H_{2}$$

PHYSICAL PROPERTIES OF DIAZONIUM SALTS

The general physical properties of diazonium saits are

- Diazomnum salts are generally colourless, crystalime souds.
- 2 These are reach; so tible if water and are stable in cold but react with water when warmed They are ess soluble in alcohol.
- 3. They are unstable and expirate in dry state. Therefore, they are generally used in sol aton state.
- Certain onezonation saids as fluorous refers for water insoluble and are stable enough to be drive and stored.
- 5. Their artism's solutions are neutral than is and conduct electricity due at the presence of ions

CHEMICAL PROPERTIES OF DIAZONILM SALTS

The reactions of benzene diagonium salts can be broadly divided into two types

- A. Reactions involving displacement of diago group
- B Reactions involving retention of diazo group.
- A. Reactions involving displacement of nitrogen

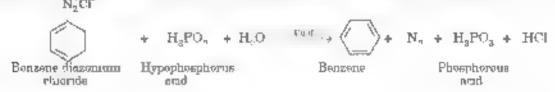
Diazo group being a very good leaving group, is readily substituted or replaced by other groups. In these reactions, nutrogen of diazonium ealits is lost as N and different groups are introduced in its place. Some of the important replacement reactions are

or Replacement by —OH group. When an aqueous solution of dioxomian solutioned up to 283 K or steam distalled in gives phenole there into the azomain group is replaced by —OH group.

Benzene diazonium chioride

Pheno.

til Replacement by hydrogen or deamination. When discons im sait is treated with mild reducing agents such as hypophorous and phospir in rach $\sim H_3 H_{\infty}$, in the presence of $\sim u_{\infty}$ salt as a catalyst at from temperature benzene is obtained preferably. The hypophosphorous and gets oxidised to phosphorous and



The data: group can also be replaced by hydrogen by heating diazonium aut with ethanol where

This complete process, a valuing directivation of our considerable by reduction of directions will be represented of the disease group by hydrogen in called denomination.

(m) Replacement by Cl and Br group. When a diasemium sait salution is warmed with cuprous chloride in hydrochome and or cuprous brounds in hydrobrome and the corresponding halder a formed.

$$N_{g}^{+}C^{\dagger}$$
 C_{1}
 C_{1}
 $C_{2}C_{1}$
 C_{3}
 C_{4}
 C_{5}
 C_{5}
 C_{5}
 C_{7}
 This reaction is called Sandmeyer reaction.

When the fiazonium sait solution is warmed with ropper powder and the corresponding imagen and the respective to ogen a introduced. The reaction is a modified form of Sandmeyer reaction and is known as Cotte compare reaction.

$$N_3^*Cl^ N_3^*Cl^ N_1^*Cl^ $$

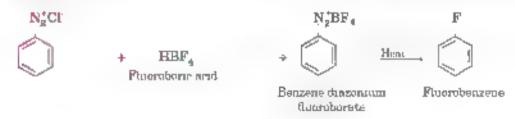
Cautermann reation is madification of Sandmeyer reactors

The yield of Sandmeyer reaction is found to be better than Gattermann reaction.

(cc) Replacement by iodo . 1) group. When aqueous solution of benzene diszonium sait is warmed with excess of potassium iodide, aryl iodide is formed.

Iodine is not easily introduced into the benzene ring directly, therefore, this reaction provides an indirect method for preparing iodo compounds.

(c) Replacement by fluoro (—F) group. When diszonium sait is treated with fluoroboric and HRF₄, benzene diszonium fluoroborite is precipitated, which in heating decomposes to fluorobenzene. This reaction is called Balz-Schremiter treation.



NOTE

The preparation of aryl halides from discounting sales is a good method and base many advantages. Anyl chimdes and broundes when obtained by direct integeration of aromain compounds give mixtures of products which are difficult to separate. However, in the discounting salt replacement method, a pure single product is formed. This also provides good synthetic route for the preparation of tryl addites and thousands which are not obtained by direct integeration.

or, Replacement by cyano (CN group. When benzene diszonium sait is treated with copper cyanide dissolved in appends KCN, cyanobenzene is formed.

This method of preparing carbodylic acids is more useful than carbonaison of Grigosical congents.

(vit) Replacement by cutro NO_e group. Narobenzene is prepared by heating diazonium fluoroborate with aqueous NaNO, in the presence of copper powder

$$N_0^+Cl^ N_0^+BF_4$$
 NO_*
 $N_0^+Cl^ N_0^+BF_4$ NO_*
 $N_0^+Cl^ N_0^+BF_4$ $N_0^+BF_4$ $N_0^+BF_4$

Alternative y more compounds may be prepared by recting diagonams and with introde and in the presence of coprous code.

$$N_3^*CJ^-$$
+ HON:

 Cu_2O
+ HC: + N.,

Notrobenzene

(viir) Replacement by thio (SH group. When disconium sait is treated with potassium hydrosulphide, throphenol is produced.

$$N_2^*CI$$
 $+$ KSH $+$ N_2 + KCI $+$ N_3 + KCI

B. Reactions involving retention of diago group

Coupling reactions: Benzene diazon imealth react with highly reactive inelelectron rich) aromatic compound is such as phenols and amines to form also compounds. Ar—N=N—Ar. The reaction is known as coupling reaction. These also compounds are generally coloured and are used as dyes. The colour of also compounds is due to extended conjugate system involving the double bond of both the aromatic rings through—N=N—double bond.

It may be noted that corpuing with phenol horars in heart medium, pH = 9-10, while that of animes occurs in faint's and endound pH = 4-5, at 273-278 K. The coupling reaction is an example of electrophilic substitution reaction in which the diazonium cation with a positive charge on the terminal introgen acts as the electrophilic and the electron rich compounds such as phenois and aimnes act as nucleophilics.

Coupling occurs para to hydroxy or amino group. However, if the para position is blocked with respect to hydroxy or amino group it occurs at ortho position. For example,

$$^{\circ}_{\theta}H_{\theta}$$
 $N^{*}=NCT+CH_{g}-CH_{g}-CH_{g}$ $OH_{g}-CH_{g}-CH_{g}$ $OH_{g}-NC_{0}H_{g}$

9 Phenylazo-4-methylphenor

In case of aromatic compounds containing both hydroxy or amino groups the coupling occurs in the alkaline medium at p- or p-position w th respect to hydroxy group and p- aromatic p- or p-position w-in respect to small group.

OH

OH

OH

OH

$$N = NC_6H_6$$
 $OH = NC_6H_6$
 An azo compounds are strongly coloured and are used as dyes. Methyl orange is an important dye obtained by coupling the disconning salt of sniphar in, and with N. Nidmethylandine

$$Na^{\dagger}C_3S$$
 \longrightarrow $NH_2 \longrightarrow \frac{NaNO_2}{273 \cdot 278 \text{ K}} \rightarrow Na^{\dagger}O_3S$ \longrightarrow N^{\dagger} \longrightarrow N^{\dagger} \longrightarrow N^{\dagger}

Sodium salt of suipharalis seed

N. N.Dimethylamine

n Reduction to arythydrazines: Arene diszomum salts are reduced to ary' hydrazines apon treatment with standous chloride and hydrodilono gold or zino dust and gold or sodium sulphide or even by electron to method.

$$Ar-N^{+}=NCI$$
 $\xrightarrow{BoCl_{2} \ HCI}$
 $\xrightarrow{No_{2}SO_{3}}$
 $Ar-NH-NH_{2} + HX$
 $Arythydrazine$

Phenylhydrazme, which is an important reagent for organic synthesis can be easily prepared it good yield from benzene diszonium chloride as

$$C_0H_0N^+=NCI$$
 $\xrightarrow{g_0Ol_2 HCl}$ $C_0H_0NH NH_2 + HCl$ Phenyihydrazine

However, if vigorous reducing agent such as Zn/HCi is used, the product is aromatic amine.

$$C_0H_0N^2 = NCi$$
 $\xrightarrow{Z_{B_1}AC_1}$ $(C_0H_0NHNH_0)$ $\xrightarrow{Z_{B_1}BC_2}$ $C_0H_0NH_0 + NH_0$

We see disconnected the property of the state of the stat

Benzeue diazonann chloride

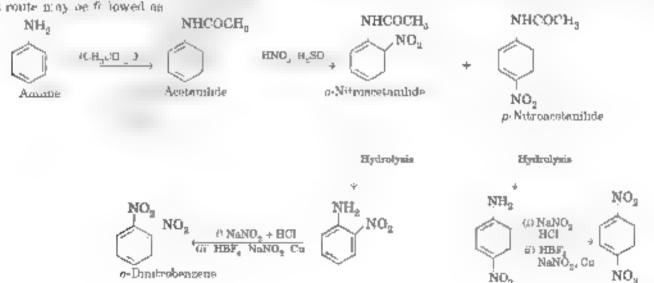
IMPORTANCE OF BENZENE DIAZONIUM SALTS IN SYNTHETIC ORGANIC CHEMISTRY

Darzons an saits are highly useful intermediates in the synthesis of large variety of aromatic rempounds Therefore these are regarded as good synthetic tools in the bands of a chemist. These can be used in prepare many classes of organic compounds especially aryll laudes in pure state. Some common examples are

1. Synthesis of 1, 2, 3-tribromo benzene. I. 2. 3-t abromo benzene as not formed an ane pure stage by direct brome nation of benzene. However, it can be prepared by the following sequence of reactions starting from p-tistronishine. through the formation of diszonium sait as .

2. Synthesis of 3, 5-tilbromotoluene. Direct browns don of soluene with Br_s/FeBr_s gives, 2, 4-dibromotoluene But 3-5, dibromotoluene may by synthesised as

3. Synthesia of a- and p-dimitrol imprenes. These cannot be prepared by direct substitution. However, thaz a-and salts route may be followed as:



a-Duistrabenzene

4. Synthesis of m-bromotoluene. It cannot be prepared by direct promination of tolliene or Friedel Crafts abgylation of bromobenzene because of o. p-directing nature of methyl group. It can be synthesized as

5. Synthesis of p-toluic acid. This can be synthesised as ,

6. Synthesis of 1,3,5-tribromobenzene. It can be synthesised as

$$\begin{array}{c|c} NH_2 & NH_1 & NH_2 & N_2^{\dagger}C^{\dagger^{-}} \\ Br_{0} & Br_{0} & Br_{0} & Br_{0} \\ Brondnetion & Br_{0} & Br_{0} & Br_{0} \\ Br_{0} & Br_{0} & Br_{0} \\ Br_{0} & Br_{0} & Br_{0} \\ Br_{0} & Br_{0} & Br_{0} & Br_$$

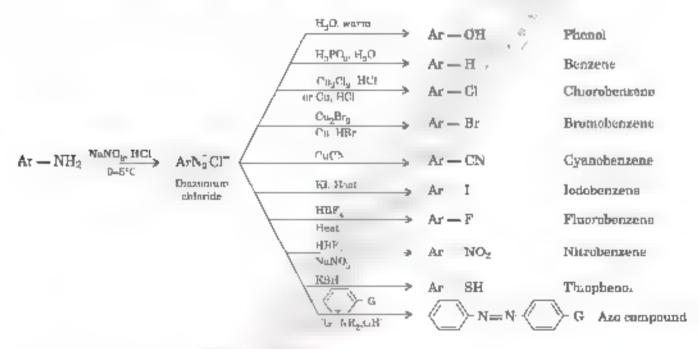
1.3.6 Tribrombenzene

7. Synthesis of m rescaphenol from m sitesunities. It can be synthesized as

8. Synthesis of p-iodonitrobenzene. It can be synthesised from p-nitroantine as

$$NO_2$$
 NO_2 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2
 NO_2

Some of the important chemical reactions and the important products formed are summarized below



Uses of diazonium salts. Diazonium sales are used

- 1 for the manufacture of azo dyes.
- 2° for the industrial preparation of mportan, organic compounds like m-bromotatione, m-bromophenol, etc.
- 3. for the preparation of a vorte of self-halogen substituted arenes.

SELLVE DE LAWPLES

J. Example 12.

An aromain compound A of molecular formula CH_0ON undergoes a series of reactions as shown below. Write the structures of A, B, C, D and B in the following reactions

D.S.B. 2016

$$C_*H_*ON = A \xrightarrow{Br_0 - KOH} C_0H_0NH_0 \xrightarrow{NaN_{C_0} - RN_0} E \xrightarrow{N_0 N_{C_0} - RN_0} C$$

$$CHOL_+ NaOH$$

$$D_2 \qquad (8)$$

So. attun

Example 18. —

Write the main products when between thosomom chievide ""HN Cl. on, to with the following.

$$\theta = H_s O$$

$$CH_aCH_aOH$$

A I S B. 2015 2018.

(iv) Copper powder/HCt (Pb.S.B. 2016)

So. afros.

$$N_{3}^{\bullet}Cl \qquad CN$$

$$V_{2}^{\bullet}Cl \qquad OH$$

$$V_{2}^{\bullet}Cl \qquad OH$$

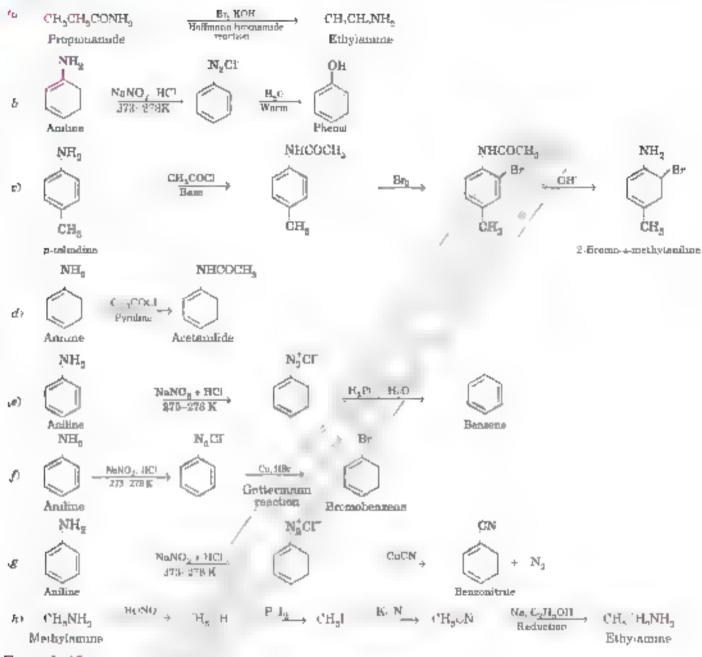
$$V_{2}^{\bullet}Cl \qquad V_{3}^{\bullet}Cl \qquad V_{4}^{\bullet}Cl \qquad V_{5}^{\bullet}Cl \qquad$$

Example 14. —

How will you convert

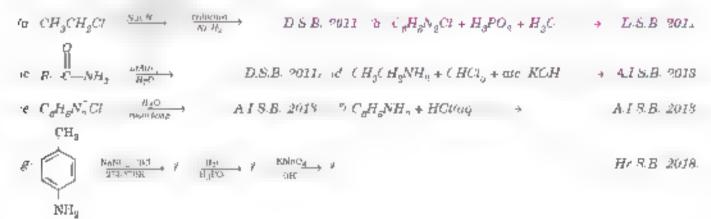
(a, proponamide to ethylamine	HP S.B 2018)
%, and ne to phenoi	Tripura S.B. 2016)
(c) p-tatuschne sato 2-brama-4-methylansisne	HPSB 2018)
Fd) anume to acetanilide	Pb. S.B. 2018)
fe, an.line to benzene	HP S.B 2018)
(f) ansure to bromobenzene	HPSB 2018)
g, andre into benzonitrde l	(Pb.S.B 2018)
(h) methylumine to ethylumine	HPS.B. 2015, 2010)

So, atron



■ Example 15. ■

Complete the following chemical equations



Solution to
$$CH_aCH_aCI$$
 $\xrightarrow{Nath N}$ NH_aCH_aCN $\xrightarrow{Pair NH_a}$ $CH_aCH_aCH_aNH_a$ (B)

.b)
$$O_8H_8N_9C1 + H_8PO_3 + H_9O$$
 $\rightarrow O_8H_8 + N_3 + H_8PO_3 + HC1$
Benzene

(c) R—C—NH₂
$$\xrightarrow{\text{LIAIR}_4}$$
 RCH₂NH₂

(e)
$$C_0H_5N_2^+$$
 CI $\frac{B_30}{R_{min}}$ $C_0H_5OH + N_2 + HCI$
Pheno)

$$NH_2$$
 NH_1 CI
 NH_1 CI
 $Addine hydrichteride$

$$B \xrightarrow[ST3, 274N]{\text{CH}_{S}} \xrightarrow{\text{CH}_{S}} \xrightarrow{\text{CH}_{S}} \xrightarrow{\text{CH}_{S}} \xrightarrow{\text{COOH}} \xrightarrow{\text{NaNing First}} \xrightarrow{\text{Fig. 274N}} \xrightarrow{\text{Pig. 274N}} \xrightarrow{\text{CIC}} \xrightarrow{\text{Hartwise acid}}$$

🗅 Example 10. 🕳

Starting from towene prepare

Solution .

In this case, the para position is blocked by $N_{\rm to}$ to prepare only ortho product.

$$CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3}$$

$$HNU_{3} \qquad HNU_{4} \qquad HNU_{5} \qquad HICOCH_{2} \qquad CI_{2} \qquad CI_{2} \qquad CI_{2} \qquad CI_{3}$$

$$NH_{3} \qquad NHCOCH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3}$$

$$CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3}$$

$$CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3}$$

$$CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3} \qquad CH_{3}$$

$$H_{3}PL_{4} \qquad CH_{5} \qquad CH_$$

Masoram S.B. 2018).

The NHCOCH, group below Ct is sment as ortho position, which is mete so TH, It is then removed.

$$(CH_3) \qquad (CH_3) \qquad (COOH) \qquad ($$

Example 17 =

Give the structures of A, B and C in the following reactions

$$if C_0H_0N_0^+BF_4 \xrightarrow{N_0M_0^+T_0} A \xrightarrow{S_0^-dic^0} B \xrightarrow{CRC_{2^+}ab^-R(d)} C \qquad A.I.S.B. 2016)$$

$$g \text{ ArNH}_2 \xrightarrow{\text{NoNO}_2 \cdot \text{HCl}} A \xrightarrow{\text{CACM}} + B$$

$$Maximum S.B. 2018)$$

Selation

(H P S.B. 2016)

$$(d) \quad CH_{3}C^{*} \quad E^{*}N \quad CH_{3}CN \quad \stackrel{\omega A i H_{2}}{\longrightarrow} \quad CH_{3}CH_{*}NH_{*} \quad \stackrel{CH_{3}CH_{*}NC}{\longrightarrow} \quad CH_{3}CH_{*}NC$$

$$A) \qquad \qquad (B) \qquad Ethyl accyanide \\ C)$$

$$e \quad C_{8}H_{5}COONH_{4}^{+} \quad ^{+} + C_{8}H_{6}CONH_{2} \quad \stackrel{B_{12}^{+}ROB}{\longrightarrow} \quad C_{8}H_{8}NH_{*} \quad \stackrel{CH_{3}COC}{\longrightarrow} \quad C_{8}H_{8}NHCOCH_{4}$$

$$A_{*} \qquad (B) \qquad N^{*}phenylethanamide \\ C)$$

$$?? \quad T_{8}H_{8}N_{4}^{+}BF_{4} \quad \stackrel{NaNO_{3}^{+}A,0}{\longrightarrow} \quad C_{8}H_{8}NO_{*} \quad \stackrel{Solitiff}{\longrightarrow} \quad C_{8}H_{8}NH_{*} \quad \stackrel{CH_{12}^{+}\omega b_{*}ROH}{\longrightarrow} \quad C_{11}H_{8}N_{*}$$

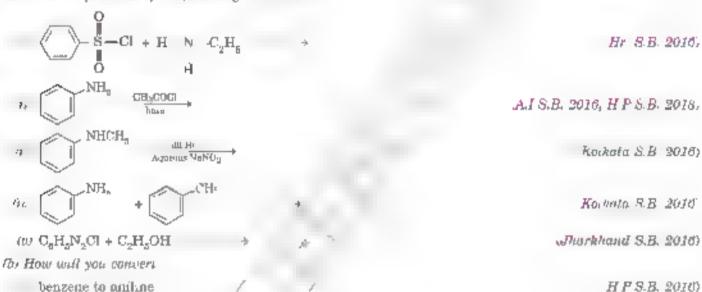
$$A) \qquad (B) \qquad Phenyl isocyanide \\ C'$$

🗅 Example 18. 🕳

g ArNH.

(a. Write the products of the following reactions

NAMES HAVE AFRICAL FORM + AFCH



So, atron.

benzene to aniline
(a) benzon soid to aniline



Conceptual Questions

Q.1. Why does methylamine has lower boiling point than methonol."

Ans. Methylamine is polar and can form intermolecular hydrogen bonds.

However, its vendency to form intermolecular hydrogen bonds is less.

Than that of methanol CH₂OH, which less highly electronegalive energies.

atom. As a result, CH₂NH₂ has lower boiling point than CH₂OH Q.1, Why is methylamine stronger base than ammonia?

Ans. Both ammonia and CH₃NH, have a lone pair of electrons and therefore, behave as Lewis bases. The alkyl group in CH₃NH₃ has + I inductive effect and is electron relessing in nature. As a result, its electron relessing tendency becomes more. Thus, CH₃NH₃ is more basic that approxima

Q.J. Anthre dissolves in aqueous HCL Why?

Ans. Andine desolves in equeous HCl due to the furnishing of water soluble eaft.

QA. Why as it difficult to prepare pure amines by ammonolysis of alkyl halides?

Ans. By ammonolysis of slkyt balides is unature of primary secondary and tertiary ammes is formed.

The separation of these annues is very difficult. Thus, it is very difficult to prepare pure annues by ammonolysis of alkyl halides.

Q.5. Methylamine in water reacts with ferric chloride to precipitate ferric hydroxide. Explain

Ans. Methylemme in water gives DH tous which react with ferric chronile to give the precipitate of ferric hydroxide as

Q.S. Electrophilic substitution in case of aromatic amines takes place more readily than benzene. Explain,

Ans. NH₀ group to erometic annues atrougly activates the aromatic ring through delocalisation of the lone pair of electrons on N-atom over the aromatic ring. However, no such delocalisation occurs in case of pentiene.

Q.7 Although boron tafluoride adds on trimethylamine but it does not add on triphenylamine. Explana

Ans. Trimethylamina has three electron donating alkyl groups and therefore arts as a Lewis base and reacts with BF, a Lewis acid



On the other hand, in triplieny lemme, the one pair of N geta delocalised over three beazene rings. Thus, the lone pair is not readily available to BP_0 for reaction

Q.S. Why does eilver chloride dissolve in methylamine solution?

Anc. Sover chloride dissolves in methylamine solution because it forms soluble complex

$$2CH_{\rm s}NH_{\rm s} + AgCI$$

Q.9. Why does the reactivity of NH, get reduced in acetanilide?

(Pb. S.R. 2018)

Ans. In acetamicale, the anide group withdraws elections from NH, group as shown below

As a result, the electron pair on introgen gets displaced to the carboxyl group. Therefore, the anabased pair of electrons on introgen is less evaluable for done tion to the arometic ring. Prosequently, the electron density at orthough para position in the benzene ring gets reduced which in turn results in reduced reactivity towards electrophilic substitution of benzene.

Q.10. Although trumethyl amine and n-propylamice have the same moreovar mass, the former boils at a lower temperature (276 K) than the latter (225 K). Why?

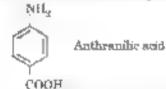
Ans. a Propylamine CH₂ PH₂CH₂NH₃ has two bydrogen atoms to the intergen atom and therefore, forms intermolecular hydrogen conding. Hence, its boung point is high. In the other aims transitively lamine. PH₁ N does not have bydrogen atom on the intergen atom. As a result, it does not undergo hydrogen bonding and bears—as boiling point is low.

Q.11. Bulphanilise acid is soluble in dil. NaOH but not in dil. HCl. Explain.

Ans. Sulphanate and exists as a switter ion. NH SO₂ In the presence of dil. NaOH, the weakly saids: NH₂ group transfers to H* to 5 'H' to form a coluble of NH₂ gH₄SO₃Na. On the other hand, SO₃ group is very weak base and therefore does not accept a proton from du. I 'Cl to form p. N. 1, CgH₂SO₂H. Hence at does not decoive at du. HCl

Q.12. Glycine exists as NH, CH₂COO, zwitter ion but anthrandic soid ,p-amino benzaic soid does not exist as switter ion. Why?

Ans. Glycule exists as switter on because the acube group. COOH donates proton to besic. NH, group as



However in authresidic and, the electron withdrawing beazene ring suppresses the tendency of a weak and/or group. COOH) to transfer its proton to "NH_c group.

Q.18. Tertiary arames do not undergo acylation. Explain-

Ph.S.B. 2014, H.P.S.B. 2016.

Ans. Animes continuous replaneatus dydrogen actor react with and chioride or acid anhydride to form substituted amides. This reaction is called acytotion reaction, to case of tertiary similars there is no replaceance if arom and therefore these do not react with acetyl chioride or acetyl childride and better and better do not undergo acytotion.

Q.14. Arrange the following sets in order of their basic strength in aqueous solution

11 NH₂, C_aH₅NH₄, CH₃NH₄, (CH₅,3N, (CH₃)3NH

(Kerala S.B. 2018)

// Amline, p-nitronafline, p-methylaniline-

Hr. S.B. 2018, A.I.S.B. 2018,

Ans. (i. O₆H₆NH₉ < NH₉ < CH₈/₉N < OH₈NH₉ < CH₈)₉ NH

Q.15. Account for the following order of increasing basicity:

RC==N « R'CH = NR « RNH, Nitrite Inter Anti-

Ans. In RC=N the N stom is sp hybridised, in R'CH — NR the N atom is sp^2 hybridised while in RNH, the N-stom is sp^3 hybridised. The more s-character in the hybrid orbital of N with the ione pair of electrons, greater will be as sendency to be strongly held by the aucleus. Therfore it will asve lesser sendency to donate its electron pair and hence will behave as weak base. Thus, as s-character decreases from RCN, to th H = NR to RNH_3 as basic character increases.

О

N

C

Ε

Р

u

А

- Area. Ammee have a lone pair of electrons on N atom and therefore, react as nucleophiles
- Q.17 Aniline does not undergo Friedel Crafts alkylation, Explain.

Pb. S.B. 2013, Hr. S.R. 2018.

Ans. Admitte does not undergo Friede. Craft advistion reaction because of the formation of salt with aluminum thinnile Lewis and which is used as a cota sal. Due to this introgen of aniline acquires positive charge and hence acts as a strong deactivating group for further reaction.

NH₁ + AlCl₂ +
$$M^+H_{\overline{q}}AlCl_{\overline{q}}$$

- Q.18. Although $-NH_2$ group is an ortho and para directing group, nitration of unitine gives along with ortho and para derivatives meta derivative also.

 CB.S.E. Sample Paper 2007.
- Ans. Under strong arrive conditions of astranson, most of the samme is converted into another am ion having NH₃ group. This group is a six-directing group, discretize, mointre sixture is also obtained using with or said gr-products.
- Q.19. The presence of a base is needed in the ammunolysis of alkyl halides. (C.H.S.E. Sample Paper 2007)
- Ans. The summonolysis of alky' hobdes gives quantum requirement on The free smalls can be obtained from amount unsalt by using a strong base.

Q.20. Aromatic primary amines cannot be prepared by Gabriel pthulimide synthesis.

.C.B.S.E Sample Paper 2007)

- Ans. Aromatic emines connot be prepared by Cabriel phthalimide synthesis because any haudes donot indergo nucleophthe substitution with the amon formed by phthalimide
- Q. 31 Suggest a structural formula of a compound having molecular formula C_sH_{ss}N (A. which is optically active, dissolves in dil. aqueous HCl and release N_s with nitrous acid.
 - And CoH, CHCH,

NH,

- Q. 22. Arrange the following in the increasing order of boiling points C,H,NH,, C,H,OH, (CH,),N (D.S.B. 2015, A.I.S.B. 2015)
 - Ans. $(CH_1)_8N < C_2H_6NH_9 < C_9H_6OH$
- Q. 33. Identify A. B. C and D in the following conversions:

(Assam S.B. 2016)

$$A \xrightarrow{\text{NaNO}_2/\text{Hid}} \text{CH}_8\text{OH} \xrightarrow{\text{PCl}_3} B \xrightarrow{\text{Rich}} C \xrightarrow{\text{aAlH}_4} D$$

Ans.
$$CH_4NH_4$$
 $\xrightarrow{NaNi + 2 \cdot HC3} \rightarrow CH_4 \cdot H$ $\xrightarrow{PCi_3} \rightarrow CH_3C1$ $\xrightarrow{Ka.N} + CH_4CN$ $\xrightarrow{MAIH_3} \rightarrow CH_4CH_4NH_5$ $\xrightarrow{Maintenance}$ $\xrightarrow{CH_4NH_4} \rightarrow CH_4CH_4NH_5$ $\xrightarrow{CH_4NH_5} \rightarrow CH_5CH_5NH_5$ $\xrightarrow{CH_5CH_5NH_5} \rightarrow CH_5CH_5$ $\xrightarrow{CH_5CH_5NH_5} \rightarrow CH_5CH_5$ $\xrightarrow{CH_5CH_5} \rightarrow CH_5$ $\xrightarrow{CH_5CH_5NH_5} \rightarrow CH_5$ $\xrightarrow{CH_5CH_5} \rightarrow CH_5$ $\xrightarrow{CH_5CH_5} \rightarrow CH_5$ $\xrightarrow{CH_5CH_5} \rightarrow CH_5$ $\xrightarrow{CH_5CH_5} \rightarrow CH_5$ $\xrightarrow{CH_5} \rightarrow CH_$

Q. 24. Arrange the following compounds in the decreasing order of basicity .

(W.B.S.B. 2016)

Ans. III > II > IV 1

- Q. 25. Name the following reactions:
 - $\ell) = C_0 H_0 N_0 + C I = C_0 C \ell / H C I + N_0$

(ii) C.H.N.*Ch Cu/HCl . C.H.Cl + N. + CuCl

(Arecon R.B. 2017)

- Ans. a Sandmeyer reaction of Gattermann reaction
- Q. 36. Arrange the following in the increasing order of their pK₁ values.
 C₀H₁NH₂, C₂H₄NH₄, C₄H₄NHCH₄

(A.LS.H. 2018)

Ans. C.H.NH. < C.H.NHCH. < C.H.NH.

Key Terms and Name Reactions

- Exhaustic alkylation. The process of oneverting an amme 1° ° or 3° and its quantum and ammonium east on trastment with excess alkyl hands.
- Deamination. The process involving discotts strong of an anime followed by reduction of discourant sawar replacement
 of discourant sawar replacement.
- Mendius reaction. The reduction of eyemide with sodium and alzohol.

$$CH_3CN\xrightarrow{\operatorname{Nim} H_5} CH_5CH_2NH_2$$

 Hoffmann bromamide degradation. Framery smires can be prepared from conides by treatment with Br. and KOH solution. The amine formed contains one carbon atom less than the parent namede.

$$RCONH_0 + Br_0 + 4KOH \rightarrow RNH_0 + K_2CO_8 + ZKBr + H_2O$$

Gobriel phthalumide synthesis. Philamonde is created with a count. NOH to give potased in the nume, which is treated with edity become or beazyl bande to form Newdy or anyl produbbane. The hydrogens of Neikyl puthalumide with "3% HCl under pressure or refluxing with NaOH gives primary amone.

• Sabetier and Mailhe method.

$$\Sigma_2 H_5 / H_1 + N H_3 - \frac{228 R}{320 R_3} \rightarrow C_5 H_5 N H_5 - \frac{16 R}{320 R_3} \rightarrow E_6 H_3 / R - \frac{16 R}{320 R_3} \rightarrow C_5 H_5 / R N$$

Schotten Boumann reaction.

Carbylamme renotion.

$$RNH_1 + CHCl_3 + 3KOH \longrightarrow RNO + 3KC1 + 3H_3O$$
Alky asteryanude

Sandmeyer's reaction.

$$N_{2} \cdot N_{2} \cdot X = C \cdot Br$$

Gottermann reaction.

$$N_{2} = \frac{X}{1 + N_{2} + N_{3} \times X} = M \cdot B_{1}$$

Balz Schiemann resotion.

Coupling reaction.

QUICK CHAPTER ROUND UP

Preparation of amines

By ammonolysis of alkyl balides

$$RNH_2 = \frac{RX}{3^{25} K} \rightarrow R_2NH = \frac{RX}{3^{25} K} \rightarrow R_3N = \frac{RX}{3^{25} K} \rightarrow R_4N^*X$$

Reduction of nitro compounds

Reduction of evanides

$$CH_{\pi}: N \rightarrow \mathcal{A}_{t}H \qquad \xrightarrow{H_{s}^{\prime}N_{s}, t_{s}AH_{s}} CH_{s}CH_{s}NH_{s}$$

⇒ Reaction of cyanides with Na. C_aH_aOH is Mendius resolion.

Reduction of amides

Hoffmann bromamide degradation

Gabrie, Phthalimide Symbesia

Aryl halides cannot be converted to aryl ammes by Gebruel synthesis

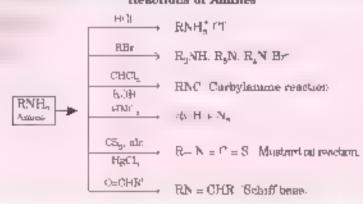
Reductive amination of aldehydes and ketones.

· Arbimidt roortina

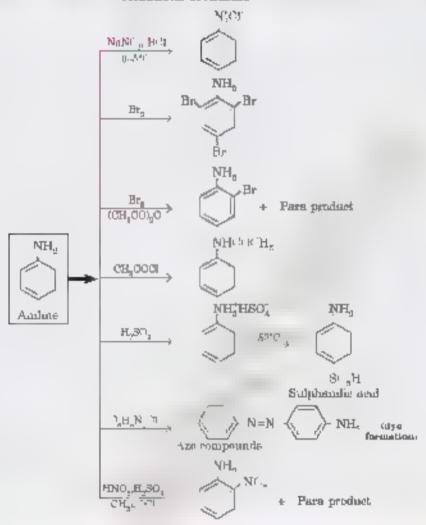
Properties of amines

- Because of the precence of a line pair if electrons on the thatogen some of NH, group andres becave as Levis bases.
- An amphetic entines are more basic thin summand. In aqueous solution. The order of besic character is $CH_{0}/_{0}NH > CH_{1}NH_{2} > (CH_{1})/_{0}N$
- Amiliae is tess been then ethylemine.

Resotions of Amines



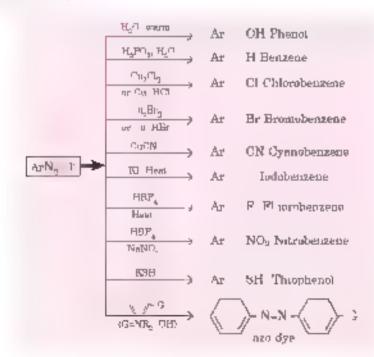
Reactions of Andline



DIAZONIUM SALTS

Aromatic primary ammes react with antrons acid at 273–298 K (see bath temperature), the product obtained is called diagonium sait $C_1H_nN_2^*X$. It contains the diagonium ion group $N \equiv N^+$ attached to anyl group.

 Aryl diazomum salts are more stable than aikyl diazomum salts.





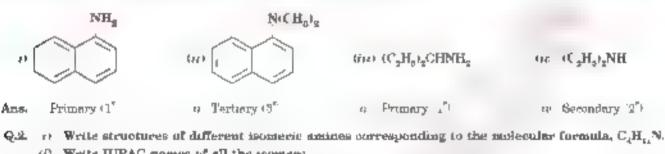




In-text Questions

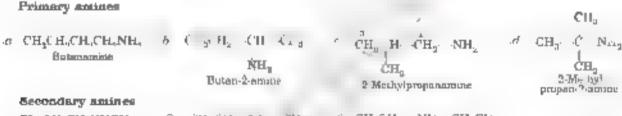


Q. Cleanify the following amines as primary, secondary and tertiary.



- - (f) Write IUPAC names of all the somers.
 - (if) What type of isomerism is exhibited by different pairs of smines?

Ane. (i), (a)



THE CALIND THE CHaCHa NH -CHaCH CH₂CH₂CH₃NHCH₃ N-Ethylethanamine N-methylproponium me ĊH, N-Methylpropan-z-analise

Tertinry names

CB, NCB,CH₂

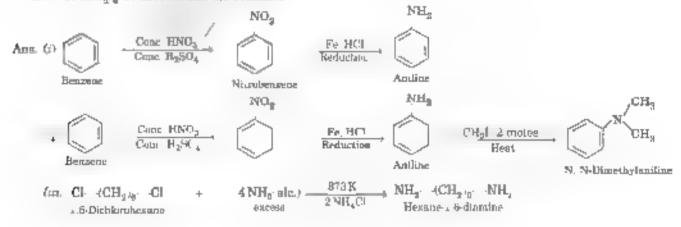
ĊH₅

N. N. Dimerbylet asnumble

- size a) b and (a) (f) are position asomers
 - c), b) (d) and o) (d) are chain isomers.
 - (g) and f) and g' are metamers.

Q.5. How will you convert

- (i) Benzene into amiline?
- (ii) Bensene into N. N-dimethylaniline
- .žii) Cl-(CH_a)_a-Cl unto heran-1,6-diamine ?



Q4. Arrange the following in increasing order of their basic strength

(i) C.H.NH., C.H.NH., NH., C.H.CH.NH. and (C.H.NH. (ii) C.H.NH., (C.H.),N. C.H.NH., (C.H.),N. C.H.NH. 366) CHANE, (CH./ANH, (CH.)AN, CAHANE, CAHACHANE,

Ans. $G_{\alpha}H_{\alpha} \cap H_{\alpha} \cap H_{\alpha} \cap H_{\alpha} = G_{\alpha}H_{\alpha} \cap H_{\alpha} = G_{\alpha}H_$

Due to +1 effect of the two C_aH_a -groups in $C_aH_{a'a}$ MH as compared to one in C_aH_a NH $_a$, the ione pair on N is more evaluable. a) $C_1H_{g^{(i)}}$ NH than $C_0H_gNH_g$ and therefore $C_0H_{g^{(i)}}$ NH is more basic than C_0H_g NH. Now aromatic source C_0H_g NH. is less basic than both C_2H_{ab} NH and C_2H_a NH, due to A effect of C_2H_a -group. Due to the presence of C_2H_a group. the electron density on the N atom becomes lower and hence seas basic. Comparing $C_aH_1NH_a$ and $C_aH_2CH_4NH_a$. N is directly bonded to the beasene ring and hence the line pair of electrons on the $\mathbb N$ atom is delocated over the bonzene ring. In contrast, N in CaHaCH,NH, is not directly bonded to the benzene ring and hence its lone pair is not delocate seed over the banzena ring. Therefore, the lone pair of electrons on N atom, $a_{ij}H_{ij}H_{ij}$ is more easily available. for protonetion shan that on she N atom or C.H.NH. Hence C.H.CH.NH. is more basic than C.H.NH., Hence the correct artier of basic character.

Due to increase in +1 inductive effect of C_{*}H_a group, the electron density in N-axon, increases and therefore, the insic. character is expected to increase as $C_aH_aNH_a + (C_aH_a,NH_a,N,L_a,T_aNH_b,$ the electron density on the Natom decreases due to the detectualities of the tone pair of electrons over the benzene ring. Therefore, all. he have etayl enumes are more besic than $C_gH_gNH_g$. Though $|C_gH_g|_0^2$ N is expected to be more onso than $|C_gH_g|_0^2$ NH_g is in iess bear because of staric hindranes to H-bonding for solvation of conjugate and derived from $C_0H_{\pi/n}$ N. Therefore, C_0H_0 N is less assist than $[C_0H_0]_0NH$ but more basic than C_0H_0NH . So, the correct order of basic strength is

$$C_2H_3+NH > (C_3H_6)_3N > C_4H_3NH_2 > C_6H_3NH_3$$

 $C_cH_cNH_c$ is less basic than $C_cH_cCH_cNH_c$ and all methyl ammes are more basic than these As explained in answer emines due to +I effect of H, group answer all However That, N is less beauthan a H, NH and Th, NH, due to every hardrance and seas etabolization by H-bonium. Therefore, the correct order is

$$(CH_{ab}NH > CH_aNH_a > (CH_{ab}N > C_aH_aCH_aNH_a > C_aH_aNH_a)$$

Q.5. Complete the following acid-base reactions and name the products :

 $dir = C_a H_{a/a} N + HCI$ n. (H,CH,CH,NH, + HCL

Ann. (a CH,CH,CH,NH, + HC) + CH, CH, CH, NH⁺, Ct я эторујацице a arregigle consolir to etilentide

a (C,H,,NH O) b (C,H,'aN + HCl

Q.C. Write reactions of the final alkylation product of axiline with excess of methyl indide in the presence of

Trieto) languago con chloride

sodium enrhonate solution.

Ans.
$$C_0H_1NH_2 + CH_2I$$
 $C_0H_2NH_3CH_3I$ $C_0H_3NH_3CH_3I$ $C_0H_3NH_2CH_3$ $C_0H_3NH_2CH_3$ $C_0H_3NH_3CH_3$ $C_0H_3NH_3CO_3$ $C_0H_3NICH_3$ C_0H_3 C_0

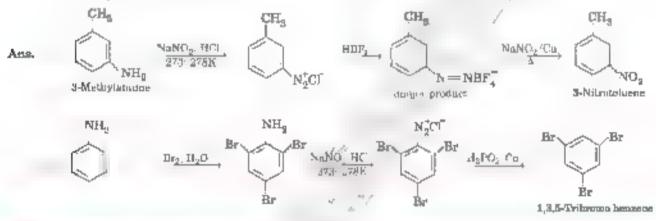
Q.7. Write chemical reaction of aniline with beautyl chierade and write name of the product obtained.

- Q.8. Write structures of different isomers corresponding to the molecular formula, C.H.N. Write IUPAC names of the isomers which will liberate nitrogen gas on treatment with nitrous acid-
- Ane. Four structural isomers are possible



Only 1° runines react with HNO, to liberate N., gas

- G.B. Convert
 - (i) 8-Methylansline into 8-nitrotolucae
- (ii) Aniline into Lil,5-tribromobenzens.





NCERT

Textbook Exercises



- Q.1. Write IUPAC names of the following compounds and classify them into primary, secondary and tertiary amines.
 - i) TCH_{2/2}CHNH₃ CH_a·CH_{ab}NH_a
- ORD CH,NHCH(CH,r),
- art (CH_{e-s}CNH_s

- (a) CaBaNHCH,
- ter (CH,CH,),NCH,
- arr) as-BrC, H, NH,

Ann. A. Propan-2-somme (1°)

- (# Propan-1-amine 1°)
- at N-Methylpropen-2-amuse (20)
- 2-Methylpropen-2-amine (10
- N-Methylbenzensmine in N-Methylamiline
- o N-Ethyl-N-methylethanamme 3°
- 54 3 Bromobenzanamine of 3 Bromoanline 1°
- Q.2. Give one chemical test to distinguish between the following pairs of compounds.
 - Methylamine and dimethylamine
- Becondary and tertiary amines

rii) Ethylemine and andine

- (ic) Aniline and benzylamine
- (p) Antline and N-methylantline
- These can be distinguished by cartylamine test. When bested with alcoholic solution of KOH and chiconform, methyl-Ans. amine gives foul small of mothyl isocyanide

Danethylamore does not give this test.

 Secondary samples give Libermann netrogramme test while d" sample do not 2" amme on treatment with HNO, prepared in situ by the action of HC on $NeNe_{ij}$ gives yellow coloured any Nen-transformation

$$(OH_3OH_2)_9NH + HO - N = O$$
 \rightarrow $(OH_3OH_2)_9N - N = O$ \rightarrow

N-Nitroschethylamine

Diethylonine (Yellow calcour)

V-Nitrosodiethylamine on warning with a crystal of phenol and cone H_aSO, gives a green solution which when made alkatine with agreeous NaCH turns deep blue and then red on dilution. Tertiary amines donet give this test

(iii) These can be distinguished by azo dye test

Dissolve the compound in cone HCl and add ice-cold solution of HNO. NaNO. + dil HCl and then treat it with an alkaline and vice of 2-naphthol. Appearance of brilliant orange or red dye understee aniline.

Benzenediazonium chloride Andline

2-Naphthol

Piscovines-3-paphthni (Orange red dye

Ethylemine does not form dye. It will give brick afferwarence due, o, he evolution of N_a but solution remains dear

(av) These can be distinguished by azo dye test

Amone reacts with HNO, NaNO, + dri, HCl. at 273, 178K to form stable cenzene diszonato chloride which on treatmen, with an alkaline solution of 2-naphthal gives on grange dye, as given in centum, 🕳 🦠 Benzylamine does not give ezo dye test

 These can be distinguished by carbylamine test. Ambro being primary amunes gives rarbylamine test. a. when heated with an alcoholic adultion of KOH and CHCl, in gives four smell of phenyl isosyamide

Q.8. Account for the following a

(i) pK_k of antline is more than that of methylamine.

.D S.B. 2008)

- iii) Ethylamine is soluble in water, whereas aniline is not.
- ωii) Methylamine in water reacts with ferrio chloride to precipitate hydrated ferric oxide.
- ac) Although amino group is a-and p-directing in aromatic electrophilic substitution reactions, aniline on ditration gives a substantial assessment of m-nitrosciline.
 - p) Aniline does not undergo Priedel Crafts reaction.

D.S.B. 2008

- p() Dinzonium entre of aromatic names are more stable than those of aliphatic amines.
- (vii) Dabriel phtholomele synthesis is preferred for synthesising primary names.
- Але. In ambine, the cone pair of electrons on N atom to delocalized over the benzane ring. As a result, electron density on the intragen decreases. On the other hand, in CH₂NH₂, if effect of CH₂ group increases the electron density on N atom. Therefore, and the is test than the theorem and before $ho K_{
 m h}$ of any time is higher than that of methylamine
 - " Ethylemine dissolves in water due to intermolecular hydrogen bonding as shown below

However because of large hydrophobic part s. hydrocarbon part of aniltae the extent of hydrogen bonding is less and therefore, aniline is insoluble in water

Methylamme is more basic then water and therefore, accepts a proton from water forming OH* ions.

These OH sons combate with Fe3+ ions, a form brown ppt, of sydrated ferric unde-

FeCl_a
$$\Rightarrow$$
 Fe⁸⁺ + SCl
2Fe³⁺ + 6OH \Rightarrow 2Fe(OH)₀ or Fe₀O₈, SH₀O
Hydrated ferric code
Brown ppt

or Under strongly and in conditions of a training to the presence of a maximum of condition $HN_{-1} + H_{2}N_{-1}^{2}$ and in given on a strong NH_{1}^{+} group. This group is descrive ting group and is m directing. So the interation of analysis n, p-maximum mainly p-product, where the introduction of analysis on gives n-introductions.

Thus, utration of aniline gives a substantial amount of an altroaudine due to protonauon of aniline

(6) Aniture away a Lewis conversaria with Lewis soid such as AICI, or firm a soft

C₆H₆NH₅ + AlCl₅
$$\longrightarrow$$
 C₆H₆NH₅ AlCl₅
Lewis bare Lewis sout Salt

As a result. N of anchine acquires +ve charge and honce + acts as a strong deactivating group for electrophilic substituion reaction. Hence spilling does not undergo Friedel Crafts reaction.

In the diagonium same of aromata, among are more stable than those of suphance amones because of dispersal of positive charge on the benzens ring due to resonance

This type of resonance stability is not possible in sikyl diszonium seits

Animal phohalimida receion gives pure 1º similes without any impurity of 2° or 5° amines. Therefore, it is preferred for the synthesis of 1º animals.

Q.4. Arrange the following I

- i) In decreasing order of the pK_{g} values $\in C_{g}H_{g}NH_{g}$, $C_{g}H_{g}NHCH_{g}$, $(C_{g}H_{g})_{2}NH$ and $C_{g}H_{g}NH_{g}$ (D.S.B. 2010)
- (ii) In decreasing order of basic strength | C.H.NH., C.H.N.C.H., C.H., C.H., O.H., - .rri) Increasing order of basic strength t
 - a) Antine, p-nitroambne and p-tolvidine
 - (b) CaHaNHat CaHaNHCHat CaHaCHaNHa

(D.S.B. 2010)

- iv) Decreasing order of basic strength in gas phase C₂H₆NH₆, C₂H_{5/2}NH, C₂H_{5/2}N and NH₅
- (ii) Increasing order of boiling point C₂H₅OH, (CH₂)₂NH, C₂H₅NH₂
- .r/) Increasing order of solubility in water $-C_0H_0NH_0$, $(C_0H_0/0NH_0,C_0H_0NH_0)$
- Area. (i) Stronger the base tereor the pK_6 value: $C_6H_6NH_2 > C_6H_6NHCH_3 > C_0H_6NH_2 > (C_2H_{6'2}NH$ Refer In text Q.4

- $(C_2H_3)_2NH > CH_2NH_2 > C_4H_2NHCH_3 > C_4H_2NH_6$ Refer Intext Q. 4
- au) a g-astronolline < nolline < n-tolughne

$$b$$
; $C_gH_gNH_g < C_gH_gNHCH_g < C_gH_gCH_gNH_g$

In gas phase reactions, the stantazation of the conjugate acids due to hydrogen banding is absent

Since the electronogativity of — is more—ban that of N—alcohols form stronger hydrogen bonds than amines. Therefore, the b.p. of CaH₂OH and mass = 46) is higher than those of CH₂hNH and C.H₂NH, each arving not mass = 46. Further since the extent of hydrogen bonding depends upon the number of H-stome on N stom, therefore, 1° similes with two H atoms on the N atom have higher c.p. then 2° annues of comparable uniterials disease daving only one H atom on N Thus, the boiling point of fig.H.NH, is more than that of HawNH. Thus, the biple of siver compounds increase as.

$$(CH_s)_0NH < C_0H_sNH_s < C_0H_sOH$$

4 Solubility decreases with atcrease in molecular mass of amines due to atcrease in size of the hydrophobic hydrocarbon. part and with the decrease in the number of H atoms on the N-atom which form hydrogen bonds. Among the given compounds. C_aH_bNH, has higher molecular mans [20] followed by C_aH_b ₂NH [7] whole C_aH_b NH_a has lowest molecular mass of 45. Thus, the solubility increases in the order

Q.5. How will you convert

- (i) Ethanoio acid into methanamine
- (iii) Methanol to ethanoic soid.
- (r) Ethanore acid into propincie acid,
- (ii) Hexanemitrile into 1 aminopentane,
- in) Ethannming into methanamine,
- (2) Methapamine into ethanomine.

(e0)	Nitromethane	into dimeth	уілжіпе.	(e67) Peopac	soro acid uito eth	sanois acid ?	
us.	CH ₃ COOH Ethanoic acid	SOCI ₂ SO ₂ , ABCI	CH ₂ COC	NH ^{310Keens}	CH,CONH,	Br ₂ KDH Hollmana bromanude reaction	ALNES Methonomine
ш	$(\underline{-}_{g})(\mathbb{N}_{2\rightarrow}(\mathbb{N}$	H ₃ Or Hydrotynia	$\mathrm{CH}^{2r}\mathrm{CH}^{r/4}\mathrm{C}($	ion son	$\mathrm{CH}^{3}/\mathrm{CH}^{4/3}\mathrm{COOL}$	WII <u>s excess</u>	$\mathbb{C} H^{4} \mathbb{C} H^{4/3} \mathbb{C} \cap \mathbb{N}$
	Hexanenitrile					Hoffmann bromamidu reaction	CH ₂ CH ₂) ₄ NH ₂ 2-Amonpentano
es.	CH ₃ OH Methana?	PCl ₄ →	CH,C1	alc, KCN	OH,CN	Bydrolysis	CH ₃ COOL Etherole acid
q.	H _a CH ₂ NH ₂ Ethanamine	HONO 4	अन् अन् अन्	NoCryO ₇ E Omidation	сн _а сно	K _g (r _j O ₇ H ≯sidadieli	OH*COOH
	"H ₃ COOH	MI ₃ excess.	CH,COONE	I ₄ 3 +	CH,CONH,	Br_KOH Hoffmans trocasouds reaction	CH ₉ NB. Methonomine
L	ChaCOOR Ethenolo odd	Reduction 3	CH*CH*OH	or PI ₃	CH*CH*I	KCN KI	CH ₂ CH ₂ CN
						H' H ₂ D Hydrolysia	CH ₀ CH ₂ COOH Propanois acid
(ex)	CH ₃ NH ₂ Methanamine	MOAD >	CHOH	P. I.	CHÎ	— E(CB) →	CH ₂ CN
						Reduction	CH ₁ CH ₂ NM ₂ Ethanomore
ν1.	H NO ₂ Nitromethene	Reduction .	:H ² NH ²	CHCITROH	CH,NL	Reduction	'H _a NH _a 'H Daniethylamine
774	CH ₃ CH ₃ COOH Propendic acid	NTA ₉	OH, OH, OUG	NH, 4	CH ² 1.H°G WH ³	Brg.K -H Hoffman bromamida readfoll	CHWHWH?
		HÚN∪ →	тн₄сн₊он	KgCtgO+ H* Omdation	CH,CHO Ethanole asid	A. Origin H Oxidanium	CH ₁ COOH Ethunous sold

Q.6. Describe the method for the identification of primary, secondary and tertary omines. Also write chemical equations of the resotions involved.

Ans. Refer Page 28-29

Q.7. Write short notes on the following

Carbylamine reaction.

- (ii) Dinzotiention
- isi) Hoffmann's bromunide reaction.
- (in) Coupling reaction

(c) Ammonolysis

(vi) Acetylation

(cli) Gabriel phthalimide synthesis

Ana, Refer Text - Page 28 o Page 41 - Page 19 reaction 7 - 4 Page 36 4 Page 10 10 Page 26 on page 14

Q.8. Accomplish the following conversions:

- i) Nitrobenzene to benzoic acid.
- (ii) Beazene to m-bromophenol

and Bensoic soid to oniline

- in) Anima to \$4.0-tribramofluorobensens
- (v) Benzyl chloride to 2-phenylethanamine | vi) Chiorobenzene to p-chioroandine

NH.

- (vii) Andine to p-bromoandine .cr) Aniline to benzyl alcohol
- (viii) Beazamide to toluene

Ans.

NO.

u Fe HO! NaOH

NaNO. HC 279 -275K

CaCN, KO

Hydrolyess

COOR

Benzene

NO. Conc RNO. + H. SI Nicropago

NO. Sm Hall Reduction NH, Br

NaNO₂ Hell 2562 HK

Br

N,CF

 $H_{y}O$ חדם 🗗

m-Bromophono)

OH

Benenic acid

$$\frac{N_8NO_4+RF_{33}}{N_8NO_4+RF_{33}}$$

2,4,6-Tribreree fluoreshonzona

Beazy) chlonde

2-Phenylathpapolae

Propanal

NaGEL + Bry

Q.9. Give the structures of A, B and C in the following reactions

OH:

Portiol bydrolysia

NaCN .

O CH,CH,I

- Q. O. An aromatic compound 'A' on treatment with equeous ammonia and heating forms compound 'B' which on heating with Br, and KOH forms a compound 'C' of solecular formula C_cH_cN. Write the structures and IUPAC names of compounds A, B and C.
- Ana. Since the compound " of motecular formula C₆H₅N is formed from B on treatment with Br₂ and KOH. Hoffmann bromanude reaction, therefore the compound B must be an anude and 'C' must be an amine. The only aromatic same beyong molecular formula C₆H₅N is ¹₂H₆NH₉, endine)
 - Since 'C' is amone, the saude from which is formed by must be senzenade (C, H, CONH, a

Thus, B is benzaude

Bance B is formed from A with aqueous ammonia and heating therefore compound A must be bearing and.

$$\begin{array}{ccc} C_{p}\Pi_{A}(a,0)\Pi & \xrightarrow{10^{1}} & \Pi_{0} & \Pi_{0} \\ \text{Because and} & & \text{Heat} & & \text{Heat} \\ (A) & & & \text{Heat} \end{array}$$

Thus, $A = C_0H_aCOOH$, $B = C_0H_aCONH_a$, $C = C_0H_aNH_a$

Q. 1. Complete the following reactions :

(al)
$$C_3H_1N_2Cl + H_3PO_3 + H_2O$$

(iii)
$$C_gH_gNH_g + H_gSO_4(some_i)$$
 +

$$v) \ \mathbb{E}_{\mathbf{q}}\mathbf{H}_{\mathbf{q}}\mathbf{N}\mathbf{H}_{\mathbf{q}} + \mathbf{B}v_{\mathbf{q}}(a\mathbf{q}_{\mathbf{r}})$$

Ann. (i)
$$C_gH_gNH_g + CHCl_g + SKOH / + C_gH_gNC + SKCl_g + SH_gO$$

(a) Pheore isocranule

$$(H) C_g H_g N_g C I + H_g P O_g + H_g C \longrightarrow C_g H_g + N_g + H_g P O_g + H C I$$
Hence

$$c_1 \subset C_1H_1NH_1 + CH_1CO \cap CH_1COOH$$
 $c_2H_1COOHCH + CH_2COOH$

Avisable

ORGANIC COMPOUNDS CONTAINING NITROGEN

Q.12. Why aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis *

Ans. Refer Text (Page 14).

Q.18. How do aromatic and aliphatic primary amines recot with nitrous and ?

Ans. Aronable primary ammes react with HNO, at 173-978 K to form aronable diazonium sales.

Apphable primary amines also react we is HNC, at 279-278 K to form all phable disconnum selts. However, these are smalled even at low comperature and therefore, decompose readily to form alcohols, generally, iredominate, and N_a is evolved.

Q.14. Give pleusible explanation for each of the following

- (i) Why are amines less acidic than alcohole of comparable molecular masses?
- 00 Why are primary amines higher boiling than tertiary amines?
- iii) Why are aliphatic amines stronger bases than aromatic amines?

Ana. Loss of proton from numes give amide ion whereas case of a proton from alcohol gives an alkacide don

Since—is more electronegative than N—bernfore—h t can accommodate the we charge more easily than RNH—onsequently RO—is more stable—han taNH—Thus, alreads are more amilion families.

. Primary amines RNH₂, have two hydrogen aroms on the N atom and therefore, form intermolecular hydrogen bonding

Tertiary amines R.N) donot have hydrogen atoms on the N atom and therefore these donot form hydrogen bonds. As a result of hydrogen bonding as primary amines, they have higher bonding points then tertiary annues of comparable moteories mass. For examining bin, of a butylamine is 3% K while, but of tert-bodylamine is 3.0 K.

Both arylamines and alkylamines are basic in nature due to the presence of one pair or N-shom. But arylamines are ess basic their elkylamines. For example, and one to use basic their ethylamines as shown by K, values.

Ethylamine
$$K_5 = 4.7 \times 10^{-4}$$

Aniline $K_4 = 4.2 \times 10^{-10}$

The less basic character of andine can be explained on the basis of aromatar ring present us andine. Andine can have the following resonating structures

It is clear from the above resonating structures that three of these. III IV and V acquire some positive charge on N atom. As a result, the pair of electrons become less available for protonation. Hence, and me is less basic than ethyl among to which there is no such resonance.



NCERT

Exemplar Problems



Subjective Questions



Objective Questions from Exampler Problems are given of Competition Fire page 207

Short Reswer Type Questions



What is the role of HNO, in the nitrating mixture used for nitration of benzenc?

Ana. HNC, arts as a base or he advantage modure HNO, + H,SO, and provides the electrophile $HNO_3 + H_2SO_4 + NO_3^* + HSO_4^* + H_2O$ Electrophite

Q.2. Why is NH, group of aniline aretylated before carrying out nitration?

Ans. Aniline is very reactive. The direct intration of anima is missinglectory accounts of the susceptibility of the ring cowards. exidation with nitric and However to carry out aitmoon, the activation of heazene ring is reduced by first acctylating anciena with acetyl chloride.

Explanation of reduced reactivity of NH, group in arctamide in scatability the crygen of the group withdraws electrons from NH_o group as shown below

As a result, the electron pair on nitrogen gets displaced to the embodyl group. Therefore, the anchared pair of electrons an introgen is less available for domestion to the aromatic ring. Consequently, the electron density at article and para positions to the benzene ring gets reduced which to biro results at reduced reactivity awards electrophian substitution

Q.L. What is the product when C.H.CH,NH, reacts with HNO,?

Ans. C_pH_pCH_pNH_p + HONO + C_cH_cCH_cOH + N_c + H_cO

Q4. What is the best congent to convert nitrile to primary amine?

Ans. Reduction of natrues with Navalcohol or LiAiH, gives primary omine

Q.5. Give the structure of 'A' in the following reaction. CH_3

$$\frac{n \cdot N_0 N N_0 + H_0 \times 270 \cdot 278 K}{n \cdot H_0 P \Omega_0 \cdot H_0 D} \rightarrow A$$

NHa

- Q.6. What is Hipsberg reagent?
- Area. Benzene sulphonytchioride CaH,SO,Cl
- Q.7. Why is benzene diazonium chloride not stored and is used immediately after its preparation?
- Ans. Benzens diazonium chioride is very anstable and therefore, it is not stored
- Q.8. Why does acetylation of NH, group of antline reduce its activating effect?
- Ans. Hefer Q. No 2.
- Q.D. Explain why MeNH, is stronger base than MeOH?
- Ans. No rogen is less electronegative than exygen. Therefore lone pair of electrons on nitrogen is readily available for donation. Hence, MeNH_o is more basic than MeOH.
- Q.10. What is the role of pyridine in the anylation reaction of amines?
- Ares. Pyridine and other bases are used to remove the side product HPT from the reaction must are
- Q-11 Under what reaction conditions (acidic/basic), the coupling reaction of acyldrazov run chloride with aniline is carried out?
- Area. Coupling reaction is carried out in mild bears conditions
- Q.12. Predict the product of reaction of smiline with bromine in non-polar solvent such as CS,

4-Bromusini fine

- Q.13. Arrange the following compounds in increasing order of dipole moment. CH,CH,CB,, CH,CH,NH,, CH,CH,OH.
- Arm. CH,CH,CH, < CH,CH,NH, < CH,CH,OH
- Q.14. What is the structure and HPAC name of the compound, allyl amine?
- Ann. H. H.A.H.NH., Propiles enune

Arts. N N-Dimethylbenzeusmine

Hence.

- Q.16. A compound Z with molecular formula C₂H₂N resots with C₂H₃SO₂C, to give a solid, insoluble in alkalidentify Z.
- Ans. Z is an attribute runing which gives a solid insolidite in base. This means that concluse with $\frac{1}{2} \frac{1}{2}

Q.17 A primary amine, RNH₂ can be reacted with CH₃—X to get secondary amine, R—NH(H₂ but the only disadvantage is that 8 amine and quaternery ammonium said are also obtained as side products. Can you suggest a method where RNH₂ forms only 2° amino?

beiszette ашубонавы**л**е

Ans. RNH₂ ROH/CHCl₃ RNC H₂/Pd RNHCH₃

Carbylamine reaction is shown by 1° amines only which results in the replacement of two hydrogen atoms attached to introgen atom of NH, group by one curbon atom. On calculation reduction, the teory and a forms a secondary amine with one methyl group.

Q.18. Complete the following reaction.

Arm OH
$$\frac{ArN_3^*CT}{OH^*/H_2O}$$
 OH $N=N$

Q.10. Why is amiltae soluble in aqueous HCI?

Ans. Amiline forms the salt amilinium chloride with HC which is water soluble

Antime (Colouriess tiquid,sparingly soluble in water) Antitutom chloride (Water soluble sa.t)

COOH

p-Thinks neid

Q.20. Suggest a route by which the following conversion can be accomplished

Q.31 Identify A and B in the following reaction.

Ans

Q.22. How will you carry out the following conversions?

Ans.
$$\begin{array}{c} CH_3 \\ \\ Thickne \end{array}$$

$$\begin{array}{c} CH_2 \\ \\ NO_2 \end{array}$$

$$\begin{array}{c} CH_3 \\ \\ NH_2 \\ \\ p\text{-Intuitine} \end{array}$$

$$\begin{array}{c} CH_3 \\ \\ NH_2 \\ \end{array}$$

p-Thiuntine diasonium chiunde

M^a Cf

Q.28. Write following conversions:

- (i) nitrobenzene acetamilide
- (ii) acetanilide → p-nitrosmiline

NO.

p-Nitro anilline

- Q.24. A solution contains 1 g mol. each of p-toluene diagranum chloride and p-nitrophenyl diagonium chloride. To this 1 g mol. of alkaline solution of phenol is added. Predict the major product. Explain your answer.
- Ans. This reaction is no examine of electrophics aromatic softetic for. In older, or medium, phenol forms phenolide on which is more electron such than phenol and bears more reactive for electrophic is unch. The electrophile in this reaction is exyldrazonium cution p-Nitrophenyldiazonium cution is a surringer electrophile man, p-tilluene chazonium cution. Therefore it couples preferantially with phenol.

Q.25. How will you bring out the following conversion?

$$\bigcap_{NH_{\mathbb{R}}} \longrightarrow \bigcap_{B_{\mathbf{r}}} \bigcap_{B_{\mathbf{r}}}$$

p-Nitrosculma 3. 4, 5-Trilacomunitrobenzene

Q.06. How will you carry out the following conversion?

$$\bigcirc \longrightarrow \bigcirc_{\mathrm{NH}_2}^{\mathrm{NO}_2}$$

Q.27. How will you carry out the following conversion?

Ans.
$$\begin{array}{c|c} \mathbf{NH}_2 & \mathbf{N}_2^* \ \mathbf{Cl}^- \\ \hline & \underbrace{\mathbf{NN}_2^* \ \mathbf{Cl}^-}_{\mathbf{273} \cdot \mathbf{278E}} \end{array} \rightarrow \begin{array}{c} \mathbf{N}_2^* \ \mathbf{BF}_q^- \\ \hline \end{array}$$

Q.28. How will you carry out the following conversions?

Ans.
$$O$$

$$\begin{array}{c}
NH_{2} \\
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Brg/CH₃CGOH





MEMORY TEST



A Say True or False

- Amines act as Levas bases.
- In equipous solution, trimethylamine is more basic than methylamine
- p-Bromosmane is formed when and me is treated with bromme water
- Azo dye test can be used to distinguish aromatic primary sinuses from aliphatic primary animes
- Catalytic reduction of carbylamines always gives primary omines
- N-Methylbenzamide on healing with squesus solution of NaOH and Br₂ gives N-methylamine.
- 7. Secondary ammes evolve No with nitrous and
- 8. Acetanilide is less basic than another
- Gabree phthelion de synthesis is used for the preparation of aromatic primary smanes
- Tertiary omines dissolve in nitrons and to form corresponding salts

R Complete the missing links

- 1. And ne on heating with furning H,80, gives
- 2. The RPAC name of lowest molecular mass tertiary
- In Schotten-Baumann reaction, aniline is heated with
- 4. Carbylamine test is used to test amines
- Libermann introso reaction is used for the detection of amines
- 6. Hunsberg reagent as
- Phenyl accyanide on reduction with hydrogen and Kaney nickel gives
- Secondary amines react with aldehydes and ketones contribung @-bydrogen to form no......
- 9. Reaction of sectamids with NeOH and Br., gives
- In Hoffmann bromanude reaction, the carbony) group is lost as

- 1L CH_CH_CONE_ + 4H LANL + . +
- 12. CH3 HaSO4. -
- 14. R₂NH + C1—C—C; ++
- 16. \sim N₂C1 + CH₅CH₀OH +

Choose the correct alternative

- Lacoyamide test is used for the detection of primary/ secondary entities.
- 2. Amino group is ortho-paralmeta director
- Primary/terhary annues donot react with Hinsberg's reagent
- Out of aniline and benzylemine, antime/benzylemine gives and dye test.
- On treating benzene diazonium chloride with hypophoephorous and, the product is phenolibenium.
- 0. pK_s of ambine in less/more than p-C₀H_s, NH_s)NH_s
- 7. K, of p-methylendine is morofless than andine
- 8. Aniline is less/more basic than ethylamine
- Electron withdrawing group on andine makes it less/more basic
- Gatriel philadimide synthesis is used for the preparation of prantary aromatic i prantary aliphotic entires

Answers



MEMORY TEST



A. Boy Tree or False

- L. True
- 2. Frage
- 0. False 2 4. 6-Trabiomonoline is formed.
- 4. True
- 5. False: Give secondary ammes.
- Feise t Secondary amides donot undergo Hoffmann bromamide reartero
- 7. Fause
- A True
- 9. Felse
- 10. True

Complete the missing links

- 1. Sulphandic and
- 8. benzoył chiorade
- 5. secondary
- 7 N-methylandina
- 9. methylamina
- R. N. K-Dimethylmethanamine
- L promary
- 6, benzene sulphonyl chloride
- В епасиры
- 10. carbonate son

$${}_{2}\mathbf{S}^{*} \circ {}_{0}\mathbf{H}^{3} \circ \circ \circ \circ$$

15.
$$\langle - \rangle$$
 + CH₆CHO + N₂ + HCl

Choose the secreti alternative

- 1. primary
- 2. netho-para
- S. tartiary

- 4. eniline
- Бепачие
- Na more

- 7. mare
- 8. 1880
- 9. Tesus

10. primary aliphatic



Higher Order Thinking Sk s



QUESTIONS WITH ANSWERS

Q.1. Aspurtame, on artificial sweetener, is a peptide and has the foliowing structure

H₂NCH CONH CH COOCH,

CH, COOH

- (i) Identify the four functional groups.
- (ii) Write the zwitter ionle structure.
- (ii) Write the structures of the amino acids obtained from the hydrolysis of aspartame,
- te). Which of the two amino acids is more hydrophobic?

(LIT 2001)

Ans. (a) The four functional groups are

- (a) NH, (amino group)
- (c) -000H (enrhoxylic group)
- (9) CONH (peptide or accide group)
- a) COOCH, ester group

CH_COO_CH_C_H_S

N. C. COMB.C. CDOCH.

CH"COOH

/ CH,C,H,

IE H.NCHCOOH

nd H.N

H_NCHCOOH

CHOC4H

H₁N₁ Ch₂ = CO_L, will be more hydrophobic due to bulky alkyl groupe

Q.3. tert-Butylamme cannot be prepared by action of ammonia on tert-butyl broadle. Why? Explain.

Ans. $tert \cdot B$ dylomine is a 3° a ky' valide the breakment with a base tike NH_{g_0} is prefere to undergo elimination reaction rather than substitution. Therefore, the product is isobutylene instead of tert-butyleness.

$$CH = CH_{2} \longrightarrow H$$

$$CH_{3} \longrightarrow CH_{2} \longrightarrow CH_{3}$$

$$CH_{4} \longrightarrow CH_{3} \longrightarrow CH_{4}$$

$$CH_{5} \longrightarrow CH_{5}$$

$$CH_{5} \longrightarrow CH_{5}$$

$$CH_{5} \longrightarrow CH_{5}$$

Imbutydene felimination? CH, C Br

NH .

CH, C NH,

Agri Bettyllaromide

deyt-Budylesmin

Q-3. Explain 3-aminoethannic acid exists as a dipolar ion as does p-amino sulphonic acid but p-amino benanic acid does not

Ans. The simplicitie—NH, group is sufficiently basic to secept an H-from COOH group. The COOH group is not strong enough to done to H* to the weakly basic ArNH, but SO,H group sufficiently strong enough to conside H* to weakly basic ArNH,

N.1.3 - 50,

р-вишли беньше всей

p-amon ethanous aicd

p-ammo sulphome seid

QA. Why are anything online some stable than alkyldiagonium son?

Ares. The stability of anyldiazonium ion is due to resonance by electron release from a- and n-positions of the ring

This type of resonance stability is not possible in alkyldiszonium ion

Q.5. p-methoxyamiline is a stronger base than aniline but p-mitroaniline is a weaker base than aniline. Explain.

Ans. Methody group $-OCH_3$ is electron releasing group and increases the electron density in N atom. Therefore at has greater electron donating tendency than anime and thus is a stronger base than anime. On the other name, there group is electron withdrawing group and therefore, decreases the electron density on integer atom. As a result, p-national, on z = w weaker base than anime

Q.6. Can we prepare amime by Gabriel phthalimide reaction?

Ans. Assume sannot be prepared by Gairner phthologische reaction because it requires are treatment of possession phthologische with C_pH_p T or C_pH_pBr . Since any halides donot undergo anciengline substitution reactions under ordinary conditions, therefore, the reaction does not occur. Hence, aniline cannot be prepared by this method.

Q.7. Sulphanilio acid is insoluble in water and organo solvents. Explain.

Ans. Sulphannic acts a some o nature and therefore, it is mantiche in organic autvents. Its mantichatty in water is typical of dipolar salts. Not all such adds dissafve in water

Q.S. Why is an amide more soldic than amme?

Ana. The smide has the following resunsting structures

This is the delocalisation of lone pair of electrons on November group amino group arquires a positive charge which makes N. H bond weak. Moreover, the amino formed after remised of a proton is also stabilized by resonance as

However no such stabilization is possible in sources.

Q.S. Which is more basic PhNH, or Ph.NH *

Ans. Arometic amines are less basic than adoptioned because the electron density of the lone pair of electrons is delocalized into the ring, mainly at ortho and pair nonthese increases in a liber of pheny groups bonded ω N increases delocalization and beare decreases basinity. Therefore, PhNH, some is more basic, but Ph.NH.

Q.10. An optically inactive compound. A) having molecular formula C_4H_4N on treatment with HNO₂ gave an alcohol ($B_{B_1}B$) on heating at 440 h gave an alkene (C_BC) on treatment with HBr gave an optically active compound (D) having the molecular formula C_4H_4Br . Identify A, B, C and D and write down their structural formulae. Also write equations involved.

Ans, buttee compound A is optically martive and contains introgen which gives attached with HNC $_{\phi}$ it is primary amine. The reactions may be given as

Q-1. A colourless substance (A) is sparingly soluble in water and gives (B) on heating with mineral ands. Compound (B) on reaction with CHCl_s and alcoholic potash produces an obscarous smed of carbylamine due to the formation of (C). Compound (A) on reaction with chlorosulphonic acid gives (D) which on treatment with ammonia gives (E). Compound (E) on hydrolysis gives sulphanilumde; a well-known drug. Give structures of (A) to (E) with proper reasoning.

Ans. The reaction of B with chloroform and alcoholic KOH gives carbylamine. This indicates that B is a primary aromatic amine. Since sulphanilamide is the final product, it means that B is amiline.

Now B is formed by the acidir hydrolysis of A which is colourless and sparingly soluble in water, therefore, A is nestanzhde. The reactions may be explained as

Q-12. An organic compound A (C_3H_5N) on boiling with alkali gives ammonia and sodium ealt of an acid B $(C_3H_6O_5)$. A on reduction gives C (C_3H_6N) which with nitrous acid gives L (C_3H_6O) . Give the structural formulae of A, B, C and D. Ans. The chemical reactions are

Q.13. Identify (A) to (G) in the following reaction scheme

E:

Ans.

Y

Tertiary stochol

Some other product

(30)

Optically active

- (a) Identify 'X) and (Y)
- .b) le (Y) optionlly active?
- (c) Give structures of intermediates, if any in the formation of (X) to (Y)

Ans. a Since compound X on treatment with NaNO,/HCl evolves N, gas. † must be a printery amone Further since of approachy active it must contain a chiral carbon. The INH₂ cannot be directly attached to a chiral carbon because such amones read-dy undergo, recemization due to introgen inversion. Therefore, the structure of X is

$$CH_{\underline{a}}$$

$$CH_{\underline{a}}^{*}C = CH_{\underline{a}}^{*}MI_{\underline{a}}^{*}$$

5. No, Y is not optically notive

ar do

Q.16. Starting with benzene and using suitable reagents, outline the synthesis of the abromochlorobenzene to p-dinterobenzene (this m-bromochobenzene)

Ans.
$$\begin{array}{c} & \text{NO}_3 & \text{NO}_2 & \text{NH}_3 \\ & & \text{Br}_2 & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & & & \\ & & \\ & & & \\ & &$$



Revision Exercises

Very Short Resour Qualitory



1. Write the IUPAC name of the following

$$\begin{array}{ccc} & \text{CH}_1 \\ \text{H}_1\text{C}+\text{N} & \text{C} & \text{CH} \text{C}_2 \\ & \text{CH}_2\text{C}_2\text{H}_6 \end{array}$$

- Write the structured formulae of all the ammee with motecular formula. "H N
- 8. What is the name of the reaction when besizene diazonium chiaride is treated with cuprous chloride?
- 4. How is indoheszene obtained from banzana diazomium attoride! Neghataya 5.B 2018
- Write a chemical reaction to prepare an aze dye from benzene discomum chronde. Uttantificad B 2013)
- Complete the reaction ArN₂Cl + H₂PO₂ + H₂O
- 7 What impress when anilose is treated with Br₂ water? Meghalaya S B. 2010

- 8. Write the reaction of aniliae with cone H₂SO₄. Januar S.B 2016
- 9. $pK_{\rm S}$ of andine 10 more than that of methylamma. Why? Assum S B. 2013:
- How will you convert andine to phenylaocyamide?
 Assum S.B. 2013)
- Arrange the following in the increasing order of beauty andme, p-introandine, p-tolumbne. Hr S.B 2013)
- 19. What is carbylamine test for 1° sames? Hr S.B 2017)
- Arrange the following in the increasing order of their basic strength in aqueous solutions

CH₂NH₁₀ (CH₃)₃N (CH₃)₂NH DSB 1043

 The strongest base among the following compounds is NH₂, H₃CNH₂, H₃C₂, NH, H₃C₄NH₃

Manupur S.B 2014)

Complete the reaction

CH₂·CH₂C = N - Not Eq. v.C., H, 6H → ? (Meghaloya S.B. 2016)

ORGANIC COMPOUNDS CONTAINING NITROGEN

Meghalova S.B. 2015

17. Write the IUPAC name of

JD.S.B. 90100

15. How is benzamide converted into benzylamine?

Pb 5:8: 3018

19. Write down diszofisation reaction.

(Ph. S.B. 2017)

20. Complete the following reaction

(Museram, S.H. 2018)

Write down Hinsberg's test for primary sinines

Pb. S.B. 2017)

22. Write IUPAC name of the following compound

CHAND H Have D.S.B. 2017)

23. Write IUPAC name of the following compound: CH,CH. ANCH, D.S.B 9017 Hr S.B 9018)

24. Write in the increasing order of basicity of the following

OnHaNHa OnHaNHa "LHawNH and "HaCH NH

Hr.S.B. 30181

--- CBSE QUESTIONS -----



25. Why do ammee react as nucleophiles? A.I.S.B. 3000, C.B S.E. Sample paper 3017

26. Arrange the following compounds in the increasing order of their solubility in water

CaH,NHa (C,H, ANH C,H,NH

AISB 301 DSB 3514

- 27. Give a chemica, test to distanguish between ethylamine CA 1 S.B. 2011
- 28. Arrange the following in an increasing order of their band क्षां प्रशासक

CaHaNH, CaHaNCH, at CaHaANH and CHANH,

A.J S.B. 2011, Hr S.B 2015

20. Write the structure of n-methyleihananine.

A. I S.R. 9018

- 50. The conversion of primary excellent amines into diazonium enite is known as at any A.I.S.B 2014
- 21. Write the IUPAC mann of the compound.

A.1 S.B. 2010

MCQs. from State Boards' Examinations

- When a primary amine reacts with chloroform in ethanolic KOH, then the product is
 - a isocyanide
- b) aldehyde
- (c) cyamide
- .यी) संस्थानित

Wharkhand S.B 2013

33. Which of the following does not reast with Hinsberg reagent?

.c) C.H.NH. (C,H,j,N)

- (b) (C₀H₀)₀NH
- a CH_NH.

Hr S.B 2013)

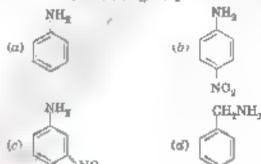
- C_gH₋N_pCl + CuCN C_aH_aCN + N_a + CaCl to
- (b) Gattermann reaction
- a) Balz-Schremano el Simonini reaction.
- d) Sandniever reaction

Hr S.B 9013

- 85. Which of the following is most basic?
 - (c) Bensylvining
- (b) Anilma
- c) Acetamlide
- (d) p-nitmentine
 - Hr S B. 2013, 2016)
- 36. Among the following which one is strangest bese?
 - .c) Ammonia .
- (b) Methylenune
- c Ethylamine
- (d) None of these

Urtarakhand S.B. 9013

87. Which of the following compound is the most basic?



West Bengal S.B. 2018)

88. The IUPAC name of CH, N -CH, CH, is



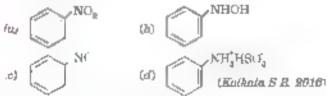
- N-Ethyl- N-methythenzenamine
- N-Methyl- N-ethylbenzenanane
- N N-Ethyl methyl benzenemine
- d) N N-Methyl ethyl senzenamme

Micorum S B. 2014)

- 39. Gabriel phthalumde reaction in used for the preparation of
 - (a. l'amine
- (b) 2° amine
- (c) 3º amme
- (d) all of these

surfornkhand S.B. 2015)

40. Which of the following compound will be formed when maline reacts with H,50,7



- 41. Which one of the following is most bosic "
 - a) C,H,NH,
- (b) NH.
- e CH,CH,NH,
- d) CH_NH.

HPS.B 2010)

- 42. C₂H₂NH₂ + HNO₃ → A, A is
 - a C_aH_zOH
- (b) C₀H₅NHOH

c C.H.

.d) C,H,NO,Hr,S.B. 2016)



ta, Benzoic acid

b) Amme

Benzomtnile

d) Benzylamine Hr S.B. 9016)

44. $CH_nC = N \xrightarrow{N_g/N_0} P$, P will be?

a CH,CH,NC

b CH₃CH₂NH₂

a CH

c CH,NH H

d CH₅NH₅ Hr S.B. 2018

45. Which of the following compound given dye test?

.c) Aniline

(b. Methylamine

(c) Diphenylanina

d) Ethylamone

Meghataya S.B. 2018

Gebruel pitthelimide reaction is used for the preparation of

(a) primary aromatic amines

b ermindary amines

(c) suplicate primary sources

d) terbary amines

Meghaloya S.B. 2018

47 The IUPAC name of the compound

a) 9-Anum 4 sthyl 2 hydroxypent 4 ene

5) 2-Amino - 4 - sthylpent - 4 - sn - 2 - nl

(c) 4-Ethyl 2 hydroxypeat 4 en 2 amme

of 2-Annue 4 methylbexen 2 of

Misorom S.B. 3018;

Short Reswer Circulture

corrying 5 or 3 marks



- 1. Explain the following
 - Tertiary amines do not andergo acyletica.
 - .a.) CH_NH, is stronger base then ammonia.
 - (ii) It is difficult to prepare pure assumes by autocoolysis of alkyl balides
- An amine (A, C₂H₂ N reacts with nitring and at 0 to 6°C to give an only layer separated from reaction mixture. Write the structure of A and its reaction with.
 - (a) acetyl chloride
 - fit) methyl magnasium brounde
- 8. (c) Why have primary names higher bailing point than tertiary amines?
 - b) How can you find out wheather a given among is a primary amone? Write the chemical reaction involved in the test you perform

H.P.S.B. 2008, Meghalaya S.B. 2016

- 4. In the following coses rearrange the compounds as directed:
 - i. In an increasing order of basic strength C₃H₆NH₆, C₄H₆ N/CH₃I₂, (C₂H₆I₃NH and CH₃NH₉
 - (iii In a decreasing order of basic strength Andine. p-natroanatms and p-tolustine
 - ,iii. In an increasing order of pK_6 values $C_2H_6NH_6$, C_8H_6 NHCH $_3$, $(C_2H_6$ $_2NH$ and $C_8H_6NH_6$ D.S.B. 2010

5. Complete the following chemical equations

$$C_8H_6N_1C_1 + C_8H_6NH_3$$
 (B) 4

(a) $C_3H_6N_9CI+CH_9CH_9OH$ \rightarrow

int RNH_a + CHCl₄ + KOH 4

D.S.B. 2010;

6. o Explain why an alltylamme is more basic than enumers?

b How would you convert

a) Antline to mitrobenzene

a) Antime to todobenzene.

D.S.B. 2011

7. ,a' Complete the following resulton

(b) Explain ethylamine is more basic than ammonia.

(c) What is early lamins exacts on?

HPSR ania)

R. (a. Write chamical test to distinguish between CH₂NH₂ and (CH₂), NH

to Pill in the blanks

" TaHaN CI CON + 2 TIO - Hr SB 9012

9. Write chemical equations for the following conversions

() Nytrobenzena to benzon acid

(a) Benzyl chioride to 2-phenyl ethanamine

re Anches to honome and

DRR WYS

10. What happens when

(r Anilme resots with Br, water

Benzene diagonarum chloride is reacted with HC in the presence of copper

(iii Acetamide is reacted with LiAlH, in the presence of either Jharkhana S.B. 2013

11.(a) Complete the following reactions

(b) Write compling reaction.

HP SH POIS

12.4a) Complete the following reaction.

ob. Convert and me into benzoir and

(c) What is Belz-Schiemann reaction? (HPSB 2018)

18. How will you achieve the synthesis of only 4-branicaniline from anilons without the production of the trisubstituted amone Meghaloya 8.8 2019

Or

- (a) Why have primary ammes higher boiling points than tertiary ammes?
- (b) Write the products obtained in the nitration of aniline
- (c) What is earlylamine reaction? (Meghaloya S.B. 2015)

14. g Identify A, B, C and D

b) Write one chemical test to distinguish between ethylemine and anilme. (Assum S.B. 2013)

16. Give the structures of A, B and C in the following resolutions.

(i)
$$C_0H_0N_0^*C\Gamma \xrightarrow{CoCN} A$$
 $\xrightarrow{H_2O/E^+} B \xrightarrow{NH_2} C$
or, $C_0H_0NO_0$ Sin. Hi $\rightarrow A$ $\xrightarrow{NnNO_2} HCl $\rightarrow B$ $\xrightarrow{H_2OEl^+} C$
 $D.S.B. 2018$$

- Write Hinsberg's test to distinguish primary accordary and tertiary amines. Utterakhend S.B. 2014
- 17 Discuss the effect of electron donating and electron withdrawing group on basicity of arometic amone

0

Write short notes on the following.

- Carbylamme reaction,
- n, Gabriel-phtheilimide aynchesia

Hr S B 3014

18. How will you convert the following

- () Nitrobenzene into amiline
- 4 Ethanoic acid into mathanamine
- to. Aniline into Nophenylethanamide.

(Write the chemical equations involved (D.S.B. 2014

19. Give the structures of A, B and C in the following reactions:

.
$$H_aB_F \xrightarrow{\mathrm{REN}} A \xrightarrow{\mathrm{LiAB}_a} B \xrightarrow{\mathrm{EDO}_a} C$$

- 20. Give chemical equations for the following reactions:
 - Gatterman Reaction
 - Curbylamme reaction
 - as Ammonolyans

Hr S.B 2018

- 21 (a, What is Hoffmann's bromamide reaction? Write the reaction involved in it.
 - 6 Secondary amine is stronger onse than tertiary amine Gree reason.
 - (c) Complete the following spections

$$6.$$
 N $^+_{\text{mix}}$ NCI + OH $^-_{\text{NCO}}$ OH $^{-\frac{1}{16}}$

(as C₂H₃NH₂+CH₃COCI → Negaland SB 2015)

- 22. Write the following name reactions with chemical equations.
- THE STORMS AND INDIVIDUE THE PROPERTY WOLF AND CHARTON OF THE MOTE

6 Ammonutyms für Huffmann bromanide resetion Inc. Coupling resetion . Utternithand S.B. 2015

20. Complete the following reactions:

Hr S.B. 2018

- 24. /a, Give chemics, tests to distinguish between primary, secondary and tertiary similar?
 - To Give research for the fullowing.
 - (i, C_cH_cNH_g is a stronger base as compared to analine
 - for Analyse does not show Priedel Crafts reaction.

Hr S B. 2018

- 25. for How will you convert emiline to benzene?
 - (b) Write the following reactions:
 - 6. Balz Schiemann reaction
 - in Carbylamme reaction.

Duscotaetion

(Pb. S.B 9015

- 25. /a. Account for the correct order of decreasing branchy of ethylamone a-emmoethenal and 3-emma propers and
 - (5) How will you convert antine into chlorobenzene
 - (c) Write a short note on carbylamme test

 $Q_{\rm P}$

- (a) Write coupling reaction.
- 6 Give a chemical test to distinguish between and inc and N-methylaniline
- (c) How will you convert benzoic seid to sname?

HPSB 2016

- 27. (a) Tertiary amines do not undergo acytation. Explain?
 - (b) Write a short note on Hoffmann's degradation reaction
 - (c) How will you convert and one note because discourant chloride?

0.

- ra, Write diazotaation reaction
- (b) Aromatic ammes cannot be prepared by Gabriel, phthalimide synthesis. Explain.
- (c) How will you convert methylamine into athylamine?
- 'do Complete the following:

CH₈OH
$$\stackrel{P_{sl_2}}{\longrightarrow}$$
 ? $\stackrel{\text{KCN}}{\longrightarrow}$? $\stackrel{\text{4H-ale}}{\longrightarrow}$? $H.P.S.B. 2016.$

###. fur Cive a discussed test to distinguish between the following pair of compounds

Methylamine and ethylamine

- To How will you convert benzene to annua?
- fc. Write a short note on Gabriel phthalimide synthesis.

Or

(a) Write a short note on ammonolysis reaction

- (b) Arulme does not undergo Friedel Crafta alkylation. Explain.
- tc. Arrange the following compounds in order of their basic strength in equeous solution.

 NH_3 , $C_6H_6NH_6$, CH_6NH_0 , $(CH_{6/2}N$

'd' Complete the following reaction.

20. for Account for the following observations:

(i) Andene does not andergo Friedal Crafts reactions.

- (ii. pK, for anxine is more than that for methylamine
- The Give a chemical test to distinguish between mathylamina and dimethylamina.

 'Hr. S.B. 2016.
- 80. /e. Why is secondary amone more basic than the tertiary amone?
 - 7b. How can 1° 2° and 0° amine be distinguished by I finaberg test?
 - (c) Complete the resutum.

Nugarand S.B. 2018,

31 At Arrange the following compounds in an increasing order of basic strength in their aqueous solutions:

NH₃, CH₃NH₂, ICH_{5/2}NH, (CH_{3/3}N

(it, Identify the products in the following reaction.

32. Identify A. B. C and D in the following conversions:

38. Complete the following reactions

 $\mu = C_0 H_0 N_0 CI + C_0 H_0 OH$

fin, C₂H₆NH₉ + HNO₂ + (Thorithand S.B. 2016)

94. Write the structures of A, B and C in the following

(i)
$$C_3H_5CONH_6 \xrightarrow{B_{52/65} \times OH} A \xrightarrow{NaNU_2 \xrightarrow{ACI}} B \xrightarrow{NC} C$$
(ii) $CH_3CI \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow{CHCl_3 \xrightarrow{ALC \times OH}} C$

$$\xrightarrow{A} CH_5CI \xrightarrow{KCN} A \xrightarrow{LiAlH_4} B \xrightarrow{CHCl_3 \xrightarrow{ALC \times OH}} C$$

 Arrange the following in decreasing order of their basic strength.

C. H.NH., C.H.NH., (C.R.) NH, NH,

(a) Identify the organic product in the following reaction. Give its IUPAC name

 $C_2H_6NH_6 = \frac{NaNO_2+BCl}{2} \Rightarrow 7$, Assam S.B. 2017

- 38. (i) Arrange the following ammer in order of increasing their basic strength Aniline, p-mirraniline, p-tolundine
 - (a) How do aliphatic primary ammee react with introns and? Give equation. (Meghaloya S.B. 2017)
- 87 (i) Write the major product of the following reaction: C_aH_cN_aCI + H_cPO_a + H_aO →?
 - 6a. Write the products formed when and/or undergoes direct interstant. Meghataya S.B. '617'
- 28. Give the chemical equations for each of the following reactions
 - (c) Hoffmann bromsmude reaction.
 - for Carbylamine reaction (Munipur S.B. 2017)
- 99. What are discontinue same?

 How as natrobenzene converted to benzenediazonium charate?

 (Man.pur S B 4017)
- (a) Write a note on Hoffmann bromamide reaction giving are obtained reaction
 - 7b. Tertiary ammes are stronger bases than primary ammes. Why? / Miscorum S.B. 2017?
- 41. (a) What happens when enthnereacts with bromine water at room temperature?
 - (b) Give a chemical test for primary sinnes.
 - (c) Write the diazousauon reaction of anilms.

Assam S.B. 2018

- 42 to A photo somes are almager base then arometic autimes Explain.
 - (b. Toluene to more easily natrated than benzene. Explain
 - (c) Discuss the deactivating m-directing nature of nitro group Hr S B. 2017
- 48. (a) Why are supplied assumes stronger base than the aromatic amines?
 - 6. What is carbylamine reaction? Give the reaction.
 - (c) Give one test to distinguish primary, secondary and tertiary amines from each other

(Nageland S.B. 2017)

44. a Classify the four wing ammes as primary secondary and tertiony

Identify the products B and C and write their formulae

Keroin S.B. 2017

45. Identify the compounds X Yand Z in the following reactions

$$C_0H_1NH_2$$
 $\xrightarrow{NaNO_3}$ X $\xrightarrow{CoBertiller}$ Y $\xrightarrow{(CH_0CO)_2O}$ X $\xrightarrow{(Mayor product)}$ $(Mayor product)$

ORGANIC COMPOUNDS CONTAINING NITROGEN

- 46. (a) Explain, with the help of channel equations, how the following compounds would be obtained from because discourse relieful.
 - # Indohenzens
 - d-Aminoazubenzene
 - b: Complete the following reaction.

H₂, mi H

- c) What will happen if smilns is treated with aqueous browne? Aleghotove S.B. 2018.
- 47. for Explain carbylamine reaction with equation.
 - How does introbenzene is reduced to antime" Give equation.
 - r) Write the IUPAC name of C₄H₅—N—CH₄

CH,

Kamutaka S.B. 9018.

- 48. /a/ Name the test used to identify primary amines using CHCl, and ethanoic KOH
 - How can you convert methyl todade to ethanomine (Kerula S.B. 2018)

>> --- CBSE QUESTIONS -



- 49. Account for the following observations:
 - (a) pK, of antique is more than that of methylamine.
 - b Mothylamine solution in water reacts with ferric chlorale solution to give a precipitate of ferric hydricide.
 - e) Andres does out andergo Friedel-Crafts resultant

A.J.S.P. 2008, D.S.B. 2008

- 50. Write one chemical reaction each to illustrate the following
 - ., Hoffmann's bromanude reaction
 - .ti Gabriel philialiniide synthesia A.I.S.B. 2008:
- a Arrange the following compounds in an increasing order of braic strengths in their squeous rotations

NHa OHANHA OHANH THOUSE

,b Complete the following reaction equations

REONH₂ $\frac{A_{1}A_{2}A_{3}}{1_{2}O}$, ii. $C_{0}H_{0}N_{1}CI+H_{0}PO_{1}+H_{2}O$ iii. $C_{0}H_{0}NH_{2}+Br_{2}$ eq). \rightarrow ALS.B *000*

- 52. Give the chemical cests to distinguish between the following pairs of compounds
 - (i) Ethylamine and amiliae
 - .u. And ne and benzylamine

A.I.S.B. 2010

- Gave chemical tests to distinguish between the following pairs of compounds
 - () Methylamine and Dimethylamine
 - # Anthre and N-Methylanihne

A.1 S B 2010)

- 54. Describe the following giving the relevant chemical equation at each case
 - (i) Carbylamuse reaction.
 - . Hoffmann bremestone reaction

A I S.B. 2012, Hr S.B. 2018)

55. Give the structures of the products A, B and C in the following reactions:

(a) CH₀CH₀H_F BCN > A LeadH₁ > B HNO₁ > O

THE SHEET A NEOD + Box B. THE ACKOR AC

A.I.S.B 9013

56. Complete the following reactions

(a) CH₂CH₂NH₂ + CHCl₃ + alo. KOH →

(at $G_0H_0N_0^*G\Gamma = \frac{H_0O}{Basin Vemp.)}$ NH_0

(hil) + HCl (uq)

AJ 8 8.20,75

57 Write the main products of the following reactions

NH₂ N₁ → N H₂PPA₂ + H₂ → 7

a Bra(mp) → ?

(iii) CH₂ —C—NH₂ — ^{2k₁ + NeUH} → 7 (A.1.S.H. 2018)

58. Write the main products of the following resultans

a. ch₂ch₈nh₂ BNO₁→7

N H CH, C CI > Bose

A.I.S B 2019

59. Write the structures of A. B and C in the following

"aHs" AT NH4 A + A HP, HOH + B PARTED + C

 6 2 2 3 4 5 4 5 4 5

A.I S B 2018

60. Give reasons.

(a) Acetylation of anilms reduces its activation effect.

For CH₃NH₂ is more basic than C₈H₆NH₀.

'm. Although NH, is o/p directing group, yet amiline on natrakion gives a significant amount of m-nitroxiciline D.S.B. 2017 AJ S.B. 2017

61 Write the structures of compounds A, B and C in the following reachons.

(b)
$$C_6H_6N_2^+BF_4^- \xrightarrow{NaNO_2/Ca} A \xrightarrow{Fa\cdot HCl} + B$$

CH_COUNTPyredise 5

AJ S.B. 20171

Long Resser Quedicas --

corrying & marks

- a Explain why and no does not undergo Friedel-Crafts reaction?
 - .b. Identify the compounds A- and (B in the following sequence of reactions:

- c Why are auphatic simmes more bane than arounded annues?
- d) Why aromatic primary amines cannot be prepared by Gabriel phthalimide synthesis?
- Complete the following reaction:

Meghalaya S.B. 2015

- 2. (a. Why are atkylamines stronger base than arylamines?
 - b. RCONH_a + Br_a + 4KOH →?
 - .c) What is disconsistion reaction?

 NH.

$$d = \frac{1}{2} + 2H_3 \otimes (1/3) \xrightarrow{P_{273} \otimes 1/2} 2018$$

 An eromatic compound 'A' of molecular formula C₇H₇ON undergoes a series of reactions as shown below Write the structures of A, B. C. D and E in the following reactions

 O_{r}

- to Write the structures of main products formed when sanding reacts with the following reagents
 - (b) Br, water

on HOL

fur, (CH₂ CO), /pyridina

 Arrange the following in the moreasing order of their builting point

CoH, NH, CoH, OH (CH, 10N)

 (c) Give a sample chemical test to distinguish between the following pair of compounds.

CH, NH and (CH,) N

CDS.B. 2015)

- 4. /a Illustrate the following reactions giving suitable example in each case
 - (i) Hoffmann bromamide degradation reaction.
 - e. Diazotiention

has Gabriel phthalimide synthesis

(b) Distinguish between the following pairs of compounds

Arabae and N-methylantine

(a. Write the structures of main products formed when bearane discount chloride $C_0H_0N_0$ Cf r rends with following respents

har H₂O

War CH, CH, OH

- 4b. Arrange the following
 - C₂H₆NH₉, C₂H₅OH (CH₀)₈N is increasing order of their bodies point.
- for Auchine, p-notes with the p-methylamidine of the increasing order of their basic strength. IALI S.B. 2015.
- 5. While the argenic products in the following reactions:

NHCH.

CREANIC COMPOUNDS CONTAINING NITROGEN

for RON

(Kockata S.H. 2016.

0. fo) Write the structures of the mean products of the following renctions

	NH ₂
	$\xrightarrow{\frac{H_{10}-3^{\omega}}{\text{Pyzadine}}}$
9	SO ₂ C C NB
,	CH ₂ CH ₂ OB

- (b) Gave a simple chemical test to distinguish between amona and N. N-dimethylamline.
- for Arrange the following in the increasing order of their phy vardes.

A L S.R. 2018.

- (a. Write the reactions involved in the following:
 - Haffmann bromsunde degradatson reaction.
 - и. Вываниевини
 - 6.5 Tabme) phtho mude symbesis
- Gave reasons.
 - 1. (CH, b) NH is more besic than (CH, t, N in an ngueone socution
 - 4. Aromater diagonnum salts are more stable than aliphatic diaxonium salts. (A.I.S.B. 2018)

Hints & Answers

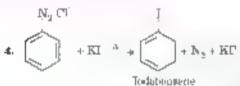
tor Revision Exercises

Len Short Inswer Onestion



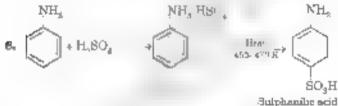
CH₂CH₂NH₄ and NH₂NHCH₃

5. Sandmeyer reaction



$$\textbf{G}_{1} = \textbf{A} \textbf{r} \textbf{N}_{3} \textbf{C} \textbf{I} + \textbf{H}_{3} \textbf{P} \textbf{O}_{2} + \textbf{H}_{3} \textbf{O} + \textbf{A} \textbf{r} \textbf{H} + \textbf{H}_{3} \textbf{P} \textbf{O}_{3} + \textbf{H} \textbf{C} \textbf{I} + \textbf{N}_{3}$$

2,4,6- Tribromoundine (white ppt)



- 9. Andine is less basic than mothylamine and therefore, its μK_c is more.
- 10. C_aH_aNH_a + CHCt_a + SKOH ale. Werm + C_aH_aNC + SKCI + SH₂O
- p-astroguding < snibne < p-taleadine
- CH_{a'a}N < CH_aNH_a < (CH_{a'a} NH
- JH₂Ch₂NH

- MachigaCohioH OH,OH,CH,NH CH, CH, C = N
- 16. Pheno) is formed
- 17 4.6-Tribromoanilme
- Ether C_BH₆CH₂NH 18. C. H. CONH. Berummide Banaylamina

80. Ar-NH₂
$$\xrightarrow{\text{NaNO}_2 \text{ HII}}$$
 ArN $^*_2\text{Cl}$ $\xrightarrow{\text{O-CN}}$ Ar-CN
(A) (B)

- 22. N-Methylpropan-2-amine
- 28. N-Ethyl-N-methylethanamme
- 24. $C_a H_a N H_a < C_a H_a C H_b N H_a < C_a H_b N H_a < (C_a H_{a/a} N H_b)$
- 26. C₆H₆NH₇ < 'C₆H₄)₆ NH < C₆H₆NH₇
- 27. Andine gives and dye test while othylanine does not give nzo dye test.
- 28. $(C_0H_0)_0 NH < C_0H_0NH_0 < C_0H_0N \cdot CH_{0/0} < CH_0NH_0$
- 29. CH_CH_NHCH_
- 80. Danzohizmbou
- N-Methyl-2-methyl propanamine.
- 38. (c) 84. (d) 32 .0 25 fz. 96. c) 37. (d) 38. (a. 319. 40. .40 41. cl 49. (a) 48. (a.
- 44. 61 45, a) 46. (c) 47. b

Additional Useful Information and Objective Questions

ADDITIONAL USEFUL INFORMATION

▶ NITRO COMPOUNDS

These compounds contain the functional group - N ... These may be allighed or aromatic according as the nitro group is attached to an alkyl or an aryl group.

C.H. NO.

or Ar-NO,

Aughetic

Association

aitre compound adtro compound

According to IUPAC system, these are named by prefixing nitro- othe name of purson alkane or areas. The positions of the cutro group and other substituents if any on the paren, chain or arene are indirected. For example,

2-lastro propane

H. A. H. H. A.H.

Nätrobenzene

No.

CH.

4 Nucrotoluccie 1 Methyl 4 nitrobensene

2-Methyl-1-astropropage al-Natiropthianal CH. Νı

4, 4. Mauri moltrene i Methyl dinitrobenzene CH, N. Z.

Ns.4 3, 4, 6-Termo botoluene

Methods of Preparation of Nitro Compounds

From alkyl halides by reacting alkyl halide with alreadous solution of effect marries.

C.H.I + AgNO (ale)

→ C₀H₅NO₀ ← Agl

From tertiary alkyl amines by reacting a primary name containing a tertiary alkyl group with KMnO, axidation

$$CH_{S}$$
 C NH_{s} $\xrightarrow{KM_{S}O_{s}}$ CH_{C} $\xrightarrow{\gamma}$ N_{G}
 CH_{s} CH_{s} O_{s}

2 Methylpropau "-amine

2-Methyl-3-myrogumpane

 From hydrocarizms. With faming HNO, amphatic alkanes give a martire of introditiones resulting by cleavage of carbon-carbon bonda.

2-Netropropates

Aromatic intro compounds are prepared by intration of benzeue

$$+ \text{HN}_{-g} \xrightarrow{\text{H}_{g} \text{HO}_{g}} \xrightarrow{\text{NO}_{2}} + \text{H}_{g} C$$

Properties of Nitro Compounds

N-broakanes are colourless, when pure, piecean, smelling liquids. Both altroalkanes and introarenes are bighly polar. compounds dipole moment 3-4D and therefore, have strong dipole dipole interactions. As a result, introditance have much higher boiling points then hydrocarbons of comparable molecular masses

 Hydrolysis. Primary articolitanes when treated with boung HCl or 85% H₀ SO₂ undergo hydrolysis to form a carbodylin. and and the corresponding salt of hydroxylamine

Secondary unity comparates upon bytholysis with boiling HO give a ketone and unityous made

Tertiary autroalkanes, however do not undargo hydrolysis with hydrochloric and

2. Reduction. The nitron kanes are reduced as:

The final product depends upon the pH of the reaction medians and mature of the reducing agent. Some common examples are to an acuta medium.

$$\begin{split} \mathbf{C}\mathbf{H}_{0}\mathbf{C}\mathbf{H}_{0}\mathbf{N}\mathbf{O}_{0} + \mathbf{S}\mathbf{H} & \frac{\mathbf{S}\mathbf{n}^{\mathsf{T}}\mathbf{H}\mathbf{C}\mathbf{I}}{\mathbf{F}\mathbf{e}^{\mathsf{T}}\mathbf{H}\mathbf{C}\mathbf{I}} + \mathbf{C}\mathbf{H}_{0}\mathbf{C}\mathbf{H}_{0}\mathbf{N}\mathbf{H}_{0} + 2\mathbf{H}_{0}\mathbf{O} \\ \mathbf{C}_{0}\mathbf{H}_{0}\mathbf{N}\mathbf{O}_{0} & + \mathbf{S}\mathbf{H} & \frac{\mathbf{S}\mathbf{n}^{\mathsf{T}}\mathbf{H}\mathbf{C}\mathbf{I}}{\mathbf{F}\mathbf{e}^{\mathsf{T}}\mathbf{H}\mathbf{C}\mathbf{I}} \rightarrow \mathbf{C}_{0}\mathbf{H}_{0}\mathbf{N}\mathbf{H}_{0} + 2\mathbf{H}_{0}\mathbf{O} \end{split}$$

Gu un neutrai mediarn

(i.e. in ackorne megiam

$$3C_0H_0NO_0$$
 $\xrightarrow{Z_0:N_0\cap H}$ $\rightarrow C_0H_0NH_0NH_0C_0H_0$
 $\stackrel{Z_0:N_0\cap H}{\rightarrow}$ $\stackrel{Z_0:N_0\cap H}{\rightarrow}$ $\stackrel{Z_0:N_0\cap H}{\rightarrow}$ $\stackrel{Z_0:N_0\cap H}{\rightarrow}$

fits calalytic reduction

$$CH_{3} CH_{3} NO_{3} + 3H_{3} \xrightarrow{Hansy \ NI} CH_{3} CH_{2} NH_{3} + 2H_{3} O$$

$$C_0H_5NO_4 + 8H_2$$
 $PLIMIC \rightarrow C_0H_5NH_0 + 2H_4O$

to, with LiAiH,

Reduction of mitrocrence give ear compounds

 Actuar with nitrous seed. Primary marosikanes reset with autrous and HONO to form blue cultured nitroso nitrosikanes which diagolat in equeous NeOH to give red colutions.

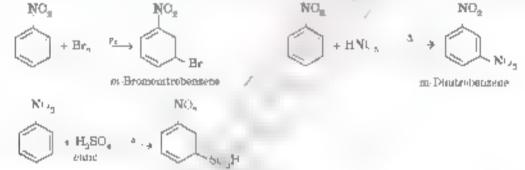
Becondary nitroalkanes give blue coloured nitroso derivative

Nitroso derivative diluel-

Tertiery autrorikanes do not react with autrous and because chass do not have a H agams

Action with aldehydes and ketones. Due to the presence of a cohom NCH. This reaction is quite similar to aid of condensation and proceeds via formation of carbanion.

Electrophilia substitution resolions. Since NO₃ group is strongly descrivelying and in-directing, therefore, in derivatives are formed.



m Nitrobenneo-untphone acid

CYANIDES AND ISOCYANIDES

When the alky) or any group is attached to the carbon of 'N group, the compounds are raised **cyanides** and when the alkyl or any group is attached to the atta

According to ILPAC system, cyemides are raised alkane nitrales and isosyamides are called alkyl parbylamines.

CH₃CN CH₃CH₄CN C₆H CN

Ethanemetrile Proponentirile Benzumtrile

CH₃NC CH₃CH₄NC I₈H₅Nt

Methyl curbylamine Ethyl carbylamine Plenyl carbylamine

Preparation

From alkyl halides by reacting askyl halide with KCN or AgCN

$$CH_3CH_2Br + KCN + CH_3CH_2CN + KBr$$
Proposenitrile

 $C_9H_6Br + AgCN(alc) + CH_3CH_2NC + AgBr$
Ethyl corbylamine

From amides

$$CH_3CONH_3$$
 $\xrightarrow{P_1O_4}$
 $C_9H_9CONH_2$
 $\xrightarrow{P_1O_4}$
 $C_9H_9CN + H_2O$

Properties

1 Hydrolysis. Alky cyanades can be hydrolysed under acute and basic conditions to give anodes, which further get hydrolysed giving carboxytic saids.

$$CH_3CN + H_5O \xrightarrow{R} CH_3CONH_3 \xrightarrow{R'} CH_3COOH$$

Amide Carbonyle acid

Isocyamides are hydrolysed to primary somines.

2. Reduction. Alkyl cyanides are reduced to primary amines either by H_0 in the presence of N_1 or P_1 or by LiA_2H_0

CH₃CN + 2H₂ Prof M → CH₃CH₃NH₂

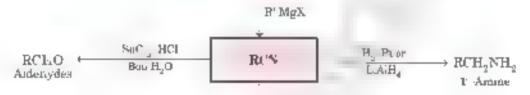
Ethyl sarine wer

Isoryamdes are reduced to secondary emmes

North CH, NHCH, CHINC + 2H. Dimethylamine '2"

The alkyl in other or examines are useful incormed also in argumin synthesis been use these and its energy converted outamates, ardeligies, setones esters, anades, carbodyna ands, etc. They provide a synthetic route for stepping up the series.

RCOR: Ketones



Cone Ht !! Purties ovderlysts



- Acetomirile "CH₂CN" is used as a solvent of choice for many organic reactions. Its extensive use as solvent is because at is not reactive in much acidic and basic conditions.
 - It has high potenty and is capable of dissolving a variety of reactants.
 - It has moderate boiling point and therefore, can be easily removed
 - It is miscible with water and a number of organic solvents.

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions M. C. Q.

MULTIPLE CHOICE QUESTIONS

with only one correct answer

Select the Correct Answer:

Amines

- Out of the following europeands, which is the most basic នា មជ្ឈម**ា**ន សារីបងរបស់?
 - a CH,NH,
- o CH, NH
- c CH_{AA}N
- A CHNH
- Which of the following success given earby annue resc-
 - (a) G,H,NH,
- (b) (C,H,),NH
- c C.H. N
- d CH_NHC_H_

- A8. Author undergoes condensation to form Schiff uses on reacting with

 - o acetyl chloride b ammonia
- (d) benzeldehyde
- An isosyanide on reduction with hydrogen in the presence of Pt paves
 - o nmide
- h primary amine
- c secondary amine of airobol
- Aniane on oxidation with Nager 20, and H.St., gives
- a laepzoio soid
- b na-amino bertznie and
- Schuff's passe
- d^+ p-benzoquiume
- Aŭ.
 - Eshylamine reacts with nitrous acid to form
 - g C,H,OH
- (b) C.H.OH, N., H.O.
- c l_aH_eN_e*Ch
- od C.H.NHOH NH.,

Hinsberg's reagent in

- a) beuzene sulphonyl chlande
- b benzene sulphonic acid
- z phenyl isocyanide
- (d) beazene sulphonamide

Ail. Which of the following reactions is given by only properly

- (a) Reaction with HONO
- Reaction with chieveform and alcoholic k. H.
- (c) Reaction with acetyl chiomde
- (d) Reaction with Grignard reagent

Ammo (-NH₀, group as susceptible to condition by HNO₃, therefore, sutraisso is done as the presence of

- a di H.SO.
- 5 C8, at 0°C
- c) CH_COCL
- (d) Writer

A10. Andine reasts with NaNO, and HCl at room temperature

- e) nitroanilme
- .b. phenol
- e' diazonium chioride d' chloroaniline.

A11, Silver chloride is soluble in methylamine due to the formetion of

- in) Ag 'CH₂NH₄)Gi = (b) Ag + CH₂Ci + NH₄Ci (ii)
- a) [Ag (CH₂NH_{0/2}]Cl (d) AgOH

A12. Diethylamine reacts with introus and to give

- c (C.H., NH*NO, 5' C.H., NNO
- (c) C.H.OH.
- (d) No und alcohal.

A18. Maximum pK, value is of

- a KOH, NH
- (b) (CH₂CH_{2/2} NH

A14. Gabriel phthalimide receive is used for the preparation of

- a primary aromatic accides
- b) secondary ammer
- c) primary aliphatic amines
- d tertarry ammer

A16. Reaction of ethylanune with chloroform in alcoholic KOH

- a) C_aH_cCN
- (b) C,H,NC
- (e) CH₂CN
- (d) CH,NC.

A.6. Reaction of sectamide with brumine water and KOH gives

- (a) CH.COOH
- (b) CH_CH_NH,
- (c) CH₄CDONH₄
- (d) CH,NH,

A17. Hoffmann degradation of m bromobenzamide gives

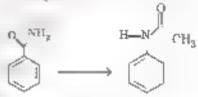
- (b) no-bromoandine
- (c) bromobenzene
- (d) m-brompethyl beggens.

A.S. Which of the following is Hoffmann inneterd oil reaction?

- to. Reaction of aromatic manne with redeform
- (b) Reaction of primary similar with CHCl,
- (c) Renotion of primary assure with CS, and HgCl,
- (d) Resetum of secondary source with introis and.

- (a, Phenyl cyanide
- b) Phenyl santyamde
- ce. Pheny isolinocyanate
- (d) p-Aminobenzene sulphomo acid

A20. The rengence needed to convert letere



- in K H Br., LiAIH
- KOH Br₀ CH₄COCI
- HONO, Object, CH, CONO.

A21. A positive carbylamme test is given by

- a N N-thmethylandine
- (b) 3, 4-dimethylanilme
- (c) N-methyl-o-methylamime
- a' p-methy benzylamme

A22. In the reaction

Xus

- A13. The compound $C_6H_{13}N$ is optically active and ceacts with HONO to give $C_6H_{14}OH$. The compound is
 - (a) N-methylbutanemine (b) 2-Aminopentane
 - (c) 1-Aminopentane (d) N.N Dimethylpropanamine
- A34. In the reaction of p-chlorotoiusne with KNH₃ in equal NH₃, the major product is
 - sa, e-talendine
- b' m-inluiduna
- (c) z-talimitra
- (d) p-chlorosuitoe
- A46. p-clibrosoilins and andimum hydrochlarids eanout be distinguished by
 - (d) Sandmeyer's reaction.
- (b) NaHCO,
- e) AgNO,
- d) Carbylanune test
- ASE CH_CH_C1 NoCN > X NoCH2 Y Acute Acute X

Z in the above sequence is

- a) CH, CH, CH, NHCOCH,
- b) CH_CH_CH_NH.
- e. CH, CH, CH, CONHCH,
- an CH,CH,CH,CONHCOCH,
- A27. The reaction of chioroform with alcoholic KOH and p-tolundure forms

A28. In the following reaction, the product A is

- A29 Which of the following compound will dissolve in an alkali solution after it undergoes reaction with Hinsberg's rement?
 - a) CH,NH,
- (b) (CH_,,NH
- e; C_aH_aNHC_aH_a
- d) (CH_{a/a}N
- A50. Secondary amines can be prepared by
 - a) reduction of nitriles
 - b) Hoffmann bromanude reaction
 - c) reduction of amides
 - d reduction of ismutative

Diazonium Sulta

- A31. Which of the following statement is mearrest?
 - (a) Directium with are crystalline solids
 - b) They are unstable and explode in dry state
 - Aromatic diazonium salte are less stable than alsphatic diazonium salte
 - d' These are readily soluble in water
- A32. In Balz-Schremann reaction, benzene diazonium chloride reacta with
 - .a, KI
- 6) GuCN/KCN
- (c) HBP,
- ri) HBF, and NaNO, Co
- A33. The sudicator methyl orange is prepared by coupling discommunication of sulphombe acid with
 - a amounte
 - b N N-dimethylamine
 - c p-methyleruline
 - d naphthon
- A54, Benzens diazonium chloride on reaction with phenol in weakly hanc medium gives
 - a diphenyl ether
- (b) p-hydroxyasobenzene
- c' chiorobenzene
- d) benzeue
- A55. Benzene diazonium chloride reacts with nitrous acid in the presence of Cu_nO to give
 - of CaHeCN
- (b) C_eH_eOH
- e) C_aH_aNO_a
- $d \subset H_n$
- A36. Which of the following reaction represents Sandmeyer's +eaction?
 - $\mathbf{E}) \quad \mathbf{C}_{g}\mathbf{H}_{g}\mathbf{N}_{2}^{*}\mathbf{C}\mathbf{I} \qquad \mathbf{C}_{g}\mathbf{C}\mathbf{N}^{*}\mathbf{K}\mathbf{C}\mathbf{N} \rightarrow \mathbf{C}_{g}\mathbf{H}_{g}\mathbf{C}\mathbf{N} + \mathbf{N}_{2}$
 - $\delta = C_g H_g N \cdot Cl = \xrightarrow{(u_1 \oplus U_1)} C_g H_g Cl + N_0$
 - (e) $C_aH_aN_a^*CI \xrightarrow{Ca_aCI_a} C_aH_aCI + N_a$
 - (e) C.H.N.CI HIN C.H.F+N.

A32. (c) A38, (b) A84. (b) A35. .c; A36. (c)

A37. And on when discoursed in cold and then treated with dimethyl ambne gives a coloured product. Its structure would be

- A38. Which of the following diazonium sait is most stable?
 - a p-Nitrobenzenediezonium chioride
 - b) 2,4-Dintrobenzenediazonsum chloride.
 - c 2.4.6-Trimtrobenzenechazonnum chloride
 - d) p-Methoxybenzenediazonium chioride
- A29. The final product in the following reaction is NH_o

- (a, p-chlorobenzylamine
- (b) p-chlorophenot
- (c) p-chlorobenzył alcohol
- td' p-chioro benzamide
- A49. The product R in the following reaction is

A37. (b) A38. (d) A39. (d) A40. (d)

В

MULTIPLE CHOICE QUESTIONS

from competitive examinations

AIPMT & Other State Boards' Medical Entrance

- B1. Which one of the following on reduction with hthiam maintain hydride yields a recordery same?
 - z' Methyl isocyanide (&) Azetamide
 - r' Methyl cyanide (d. Nitroethane-

(CBSE Med. 2007)

B2. In a reaction of entities a columned product C was obtained.

The structure of C would be

(c)
$$\sim$$
 N=N \sim NCH₃

(C B.S E. P M T 2008

B3. Predict the product

- B4. Nitrobanzene can be prepared from benzene by using a marture of conc. HNO₃ and H₃SO₄. In the marture, HNO₃ acts as even.
 - .e) and
- .Б: Баве
- (c) catriyat
- d) reducing agent

(C B.S.E. PMT 2000

- R5. Another idea bounded with the following reagon temperately. Which one of these would yield methyl amane?
 - (a) Hot cone H.SO.
- b PCL
- (c) NaOH Br.
- .d) Sotlalime

C B.S.E PMT 9010,

B6. Antime in a set of the following reactions yielded a columned product 'Y

NH.

$$\underbrace{\begin{array}{c} N_0NO_{s_0}HC^{q_0}\\ 27S,278\ K_0 \end{array}}_{} X \xrightarrow{\quad N_0N_0 \text{ dimensionless}} Y$$

The structure of Y would be

$$\alpha$$
 H_1C $N = N - NH$

CH₃

C B.S.E. PMT 2010.

- B7. Which of the following statements about primary amines is false?
 - .c) Anyl ammes react with introus and to produce phenols
 - .b' Aikyl ammer are stronger bases than ammonia
 - .c. Aikyl ammes are stronger bases than aryl ammes
 - d) Alltyl ammes react with instrona acid to prince alcohols (C.B.E. PMT 2010)
- BR. What is the product obtained in the following reaction?

a
$$NO_2$$
 $\frac{N}{NH_4Cl} \rightarrow 7$

a $NH_4Cl \rightarrow 7$

b N

NH

NH

AIPMT 2011

89. In the reaction

- a H.FO., and H.O
- b H* H₀O
- e) HgSO, H,SO,
- .d) Cu₂Cl₂

NEET 2013

- B16. Nitrobenseon on reaction with cone HNO₂/H₂SO₄ at 20-100°C forms which one of the following product ?
 - a) 1 4-Dimtrobenzene
 - 5 1, 2, 4-Transtrobenzene
 - .c 1 2-Dimtrobensene
 - d 1,5 Dunitmbenzene

NEET 2015

- B.1 Which of the following will be most stable diagonism soft RN. *X"?
 - (a) CH_N, K
- (6. C,H,N, 'X'
- ec CH_CH_N X
- (d) O.H.CH.N. X

AIPMT 2014. Kametaka CET 2018

B12. In the following reaction, the product .A.

B18. The number of structural isomers possible from the molecular formula \mathbb{C}_3H_gN as:

125 F

B 3

AJPMT 2015

B14. The following reaction

is known by the name

- ay Acetyisidou reaction
- 2), Schotten-Beumarus reaction
- /c. Friedel-Craft's reaction.
- ed) Perkana reaction

AIPMT 2015.

B16. Method by which and me cannot be prepared is

- (a, reduction of astrobenzene with H./Pd m ethanol
- 4b potassium selt of obthe limitde worked with chlorobenzene followed by hydrolysis with agreeous NaOH solution.
- (e) aydrolysis of phenylisocyanule with serdic solution.
- (d) degradation of banzamide with bromins in alkaline solution. AIPMT 2015.

B16. The electrolytic reduction of astrobeogenesis strongly endice mediana produces

(q. azobensene

(b) emiline

4- p-eminophenol

(d) azozybenzene

AIPMI 2015)

B17. The correct statement regarding the basisty of any lamines

far arylamines are generally more basic than alkylamines because of aryl group

- (b) arylamines are generally more basic than alkylamines because the introgen stain in arylamines as p-hybridised.
- (c) arylamines are generally less bour than alkylamines because the artificer lone-near electrons are delocalised by interaction with the arminationing n-electron system.
- (d. arylanumes are generally more basic than advisations because the nitrogen lone-pair electrons are not delocalmed by interaction with the aromatic ring π-electron system

NEET 20101

B18. Which one of the following netro-compound does not react with nitrous and?

NEBT 2018)

Big. A given introgen—containing aromatic compound A reacts with Sn/HCl, followed by HNO₂ to give on unstable compound 'B' B', on treatment with phenol, forms a beautiful cultured compound C' with the nucleonlar formula $\Gamma_{cs}H_{bs}N_{s}O$. The structure of compound A is

VEET 20.0

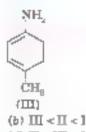
P20. Which of the following reactions is appropriate for converting acetamide to methanismine?

- a) Hoffmann bromamude reaction
- b) Stephen's reaction
- Gabrie) phthalimede synthesis
- (d) Carbylandov reaction

(NEET 2017)

B21. The correct increasing order of basic strength for the following compounds us

NH NH, NO. Ω (II)(a) III < I < II</p>



c) □ < I < Ⅲ</p> (d) $\Pi \times \Pi \Pi \times I$

OVEET 2017

- B32. Nitration of anilose in strongly arrive medical also gives m-nitronnline because
 - a) inspite of substituents, introgroup always goes to only en-position
 - in electrophilic substitution reartions, amino group is meta directive
 - (c) in absonce of substituents, nitro group always goes to
 - d) in acidic (strong) medium, ambao is present as geillinagen ann.
- B38. Amine intrested with NaNO,/HClat 0°C to give compound X which on treatment with ourrous cyanide gives another compound Y When compound Y is treated with H./N. compound Z in obtained. The compound Z is

.c) Benzyl alcohol

(b) Beazylamme

(c) N-ethylanubne

(d Phenol

(e) Phenyl hydroxylamine

Kerale PMT 2010.

- B34. The strongest ones in aqueous solution among the following
 - (a N N-diethylethanamine b) N-ethylethanamine
 - (c) N-methylmethanamina d) ethanamine
 - te) phenylmethanamine

Keralo P M.T 2011

- B25. Aniline is treated with bromme water to give an organic compound X which when treated with NaNO, and HCl at 0°C gives a water soluble compound Y' Compound Y on treatment with $\operatorname{Cu}_n\operatorname{Cl}_n$ and HCl gives compound TСотронной 'Z' на
 - (a) a-bromachiarabecizene
 - (b) p-bromochlorobenzane
 - (c) 2, 4, 6-keibramophenal
 - (d) 2, 4, 6-bribromoulu probenzene
 - 2 4-dibromophenol

Kerala P M T 2011

- B26. Andimum bydrogensulphase on beating with sulphare arcid at 459-470 K produces
 - a) becseon sulphonic acui
 - anthromite and
 - amline
 - ber significant susagedonume-en Co.
 - ви)рижиніе венф //

Okerata P.M.T. 2011

- B27. Secondary ammes could be prepared by
 - (a) reduction of ostraes
 - b Huffmann artraenude reaction
 - c' reduction of smides.
 - (d) reduction of isomitriles
 - (a) reduction of pitre compounds

Kernta P.M.T 9015

B28. Which one of the following ammee cannot be prepared by Gabriel phthalimide synthesis?

a Ethylenope

b -aupropylamme

и и Регрумлине

d Ethylmethylomine

Adylamine

(Kerala PMT 2015)

R29. Which one of the following ammes forms a non-scatte and alkah maaluble product with p-toluenes ulphonyl chioride?

:a Tertiary butylemine

To a Bucylamine

Isobutvianuna

d Diethylamme

4. N. N.Damethytethylemme

Kerain PMT 2016)

B30. Which of the following compound is most basic?

or Amorate

b Tychoberylemone

e e-Nitraamline

id o Politidine

e p Methoxynnilme

Kerola PMT 2018

JEE (Main) & Other State Boards' Engineering Entrance

- B81. Phorobenzene can be synthesized in the laboratory
 - (a) from aniline by diszotiantion followed by besting the diazonium salt with HBF,
 - δ^* by direct flaorination of benzene with F_a gas
 - by reacting bromobenzene with NaF solution.
 - a) by heating phenol with HF and KF

A I E E.E 2006:

B82. In the chemical reaction,

 $CH_aCH_aNH_a + CHCI_a + 8KOH \rightarrow (A) + (B) + 8H_aD$

The compounds A) and B are respectively

- (a) CH,CH,CONH, and 3KCl
- (b) G,H,NC and K,CO,
- (c) C_aH_aNC and 5KC1
- (d) C.H.CN and 3KC

A.I E.E E 2007

B33. In the chemical reactions

NH

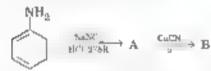
$$\frac{NaNC_{\alpha}}{HCL^{-pp}g^{-}K} \to A \qquad {}^{AGF} \xrightarrow{A} F$$

The compound A and B' respectively are

- sor benzeue disaconium chloride and fluorobenzeue
- b) pitrobenzene and chlorobenzene
- (c) nitrobenzene and Duorobenzene
- (d) phenol and benzene

AIEEE 2010

B34. In the chemical reactions



the compounds ${f A}$ and ${f B}$ respectively are

- (a) beuzenediazoni am chioride and penzonitrile
- (b) Nitrotienzene and chlorobenzene
- (c) Phenol and bromobenzene
- (d) Fluorobenzene and phenol

OLLEEE, 2011

- B35. A compound with molecular mass 180 is acyleted with CH_COCI to get a compound with molecular mass 390. The number of amino groups present per molecule of the former examplement in
 - 1a) (b)

b) 2

d) 4

B36. Coundering the basic strength of minnes in equeous solution which one has the smallest pK, value?

- a) C_aH_aNH_a
- (b) CH_{ab}NH
- .c) CH,NH,
- $(d')(CH_{a'a}N)$

FE Moin 2014 B37. On beating an aliphetic primary agence with chloroform and ethanolic potassium hydrouide, the organic compound formed in

- .e.) en alkyl mocyanide
- an alkanol
- cl an alkanediol
- d) an aftyl cyamide

JEE Mmn 2014

- B38. In the Hoffmann promamule degradation reaction, the number of motes of NaOH and Br, used per male of samme produced are
 - .c) one mole of NeOH and one mole of Br.
 - b four males of NoOH and two males of Br_{*}
 - (c) two moles of NaOH and two moles of Br_a
 - d) four moles of NsOH and one male of Br.

B30. Which of the following compound will give significant amount of meta product during mono-aitration reaction?

B40. The increasing order of basicity of the following compounds

- (a) $(A) \times (B) \times (B) \times (D)$
- b B. < (A < C) < (D)</p>
- r Bea De
- $d'(D) \in B \setminus (A_i \times G)$

(JEE Main 2018)

B41. The correct order of mercasing basic nature of the following

- p 2 cocle3c4 6, 5<2<1<3<4
- ec) = 0 = 1 = 4 = 8
 - d 5 < 2 < 1 < 4 < 3
- (a) Z < 5 < 4 < 5 < 1
- (Kerola P.E.T. 2008.

B43. The final product in the following sequence of reaction is

- B40. Choose the amide which on reduction with LtA.H., yields a secondary amine
 - z Elbanasside
 - b N-Methy ethanamide
 - .c) N. N-dimethyl ethenemde
 - .d) Phenyl methenemide
 - e) Butanamide

(Kerata C E T 2009)

- B44. Which one of the following is the correct order of increasing basic strength of astrogen compounds in aqueous soultion?
 - $a \in NH_a \circ C_a H_b NH_a \circ C_b H_b NH_a \circ C_b H_b CH_b NH_a$
 - U) $C_aH_aNH_a < NH_a < C_aH_aCH_aNH_a < C_aH_aNH_a < (C_aH_a)_aNH_a$
 - (e) $(C_0H_0)_0NH < C_0H_0CH_0NH_0 < NH_0 < C_0H_0NH_0$ er H. NH.
 - d' C,H,CH,NH,<C,H,NH,<NH,< C,H,NH,</p> K C. H. h NH
 - (a) $C_0H_aNH_a < C_aH_aNH_a < NH_a < (C_0H_a)_bNH$ < O_H_CH_NH_ (Keralo P.E.T. 2012)
- B45. Benzylamine is a stronger base than anilms because
 - The loss pair of electrons on the mirrogen atom in benzylemnie is derocalised.
 - b) The lone pair of electrons on the entrogen atom in amiline is delocalised.
 - (c) The lone pair of electrons on the mitrogen atom in entime is not involved at resonance
 - d' Benzylamine basa higher moleculer mass than an as-Kamatako (*E.T 2013)
- B40. Which one of the following given amine on heating with amide?
 - io. Br., iti aqueous KDH
 - b) Br., in alcoholic KOH
 - (c) Cl., in softman
 - d) Sodium in ether

(Kurwatuko CET 2013.

- B47. Positive parhylamine test is shown by
 - N N-dimethyleniline a trus hylmmine
 - (c) N-methylamiane / d' p-methylbenzylamme
 - (e) dimethylamine (Kornia PET 2013)
- ${f B40}.$ The best reagent for converting 2-phenylpropanamide into '-phenylpropadamine is:
 - (a Br., in aqueous NaOH
 - (b) excess of H_e
 - (c) sodine in the presence of red phosphurus
 - of LaA.H, in ether GAMU Engg 2015.
- B40. The reagent with which the following reaction is best accomplished is



- (a) H,PO, (b) H,PO,
- (d) NaHSO₄ (WB JEE 2014) (a) H,PO,
- B60. An annne C, H, N reacts with penzene sulphonyl chioride to form a white precipitate which is insoluble in eq. NeOH. The amine is



WB JEE 3011

- H61. An aromatic compound A (C H,N) on reacting with NaNO./HCl at 0°C forms benzyl alcohol and nitrogen gas The number of econers possible for the compound A is
 - (6).7
 - (c) B
- (d) 6 Karnataka CET 3014)
- H62. One of the following anades will not undergo Hollingon. bromamude reaction
 - to CH,CONHCH,
- (b) CH, CH, CONH,
- fe, CH, CONH,
- (d. CaHaCONH,

(Karnetaka (ET 2016

- B58. In the given series of reartions.
 - ale Agen LABA Y a. Brancopropers

The IUPAC name of product Y is

- (a) N-isopropylmathanamine
- (b) N-methylpropan-2-amine
- ic. N-methylpropanamine
- (d) Butan-2-amme. /Karnataka CET 9015
- B54. Diethyl amine when treated with autrous and yields
 - ia. Diethyl ammonium nitrite
 - 6, Ethyl alcohol

1 NH.

- ic. Nontroso diethyl anime
- d. Triethyl ammonium intrite. MH-CET 10/5
- B55. The correct order of basicity of the following compounds in
 - NH. 100 1 < 2 < 3 < 4 (b) 1 < 2 < 4 < 8
 - 6. 2 cl c 3 c 4 (d. 4 c 5 c 2 c 1

(WB- JEE 2018)

- B48. do Bd9. a B50. 5 B52 a B43. 5 B44 b B45. b B40. a B47 d 651
- B68. (b) B64. (c) BGG. (c

- Böt. Which one of the following can be prepared by Gabriel phtheirmide synthesis ?
 - a) Annime
- (b) a-Toluidina
- Co Benzylamine
- (d) N-Methylethanamine
- e) 4-Bromoandine
- (Kerala PET 2010)
- B57. 4-Netroteluses is treated with bruzing to get compound P P is reduced with Sn and RC; to get compound 'Q' 'Q' is diazotised and the product is treated with phosphinic and to get compound 'R' 'R' is exidized with alkaline KMnO. to get compound 'S' Compound 'S' is
 - (c) 2-bramo-4-bydrosybanzoic acid
 - benzoie seid.
 - 4-bromobenzoue neid
 - disa singnedammed-fi-
 - .e) 2-bromobenzoic send

(Kerala PET 2016)

B58. In the following sequence of reactions:

$$A \xrightarrow{\rm Reduction} \to B \xrightarrow{\rm 1900_2} \xrightarrow{\rm 194_3} {\rm 194_3} \cdot {\rm 194_4} \cdot {\rm 194_4$$

The compound A 48

- (a) propose estrile
- (b) ethane mtrile
- el nitromethans
- (d) methyl teogyanate
 - Karnataka C E T 2016
- B50. An organic compound A on reduction gives compound B. which an reaction with trachion methane and country potasii. forms C. The compound 'C' on catalytic reduction gives Neurathyl benzenamme, the compound A is
 - (z) nutrobengene
- (b) nitromethane
- .c) methanamune
- (d' benzenamme
 - Karnataka C.E.T. 2018
- B00. The compound that would produce a natuseating smell/adour with a hot mixture of chloroform and ethanolic potassium nyaroxide is
 - (a) PhCONH,
- (b) PhNHCH.
- · PLNH,
- of PLOH
 - WB JEE 2017
- B81. Among Me, N. C, H, N and McCN Me = methyl group), the electronegativity of N is in the order
 - $a \in MeCN > C_sH_sN > Me_sN$
 - b C_aH_oN > Me_oN > MeCN
 - to Ma,N > MaCN > C,H,N

 - d) electronegativity is same in all. (WB JEE 2017)
- B82. The yield of acetamade in the reaction 100% conversion. of 9 motes of artificie with mode of ocetic analydade is:
 - a 270 g
- 0 IS6 g
- (c. 67.5 gr
- (d) 177 g
- (WB JEE 2017)
- BOS. The product Y for the below reaction as



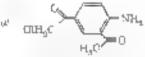
CECT, /SKOH

40

Kerala P.E.T 2017)

864. The product formed in the following reaction is





(Kerolo P.E.T 9017)

- B65. What product will form when N. N-dimethylamline reacts. with NaNO, and dilute HCl at low temperature?
 - (a) p-Nitrogo-N, N-dimethy, aniline
 - b) Methyl-n-nerylamina
 - (c) #i Benzenediazonium diforide
 - (d) N-Nitroso-N-methylanilme

JK CET 2018"

- B66. Which of the following shows the correct reaction for tuvrobenzana reduction?
 - Nitrobenzene reacts with Zn dust and NH₂CL to produce
 - Narobenzene reacts with LaA.H, to produce phenyl hydroxylamine.
 - to Nitrobenzene reacts with Fe and H.A to produce nitrosobenzene
 - (d) Natrobeazene reacts with 2n dust and NH, Cl to produce phenyl bydrosyluudos.

(J K CET 2018)

(LLT Bereating 2008.

Competition File

- B67. Identify the correct beauty order in the nitronnilines?
 (Symbols and natations excry their usual meaning
 - a) a-Nitrosodines < p-nitrosodines < m-nitrosodines
 - b) m-Nitroanilmes < p-astroanilmes < o-astroanilmes
 - c) p-Nitroanilmes < o-nitroanilmes < m-nitroanilmes
 - .d) o-Nitroandines < m-nitroandines < p-nitroandines .J K CET 2018

B08. Identify 'M' an the following asquence of reactions

WB JEE 2018

- B69. If andme is treated with cone H₂SO₄ and heated at 200 °C, the product is
 - a unilinam sulphase
 - b. beozeneaulphonic seid
 - c) st-animobenzenesulphoms and
 - hipa allimadalua (b.

(WB JEE 2018)

- B70. Which of the following in more basic than amiline?
 - a) Diphenylamina
- (b) Triphenylamine
- e) p-Nitroaudins
- (d. Beazylanine

Karnataka CET 2018

- B71. The reaction of penzenediazmanian chandle with ambine yields yellow dps. The name of the yellow dps as
 - a p-hydroxynanbenzene
- sh p-matanambenzene
- pautroazabenzene
- o' o nitroazobenzene

Karnataka CET 2018

- B7%. The astronation of N,N-dimethylandine takes place through the attack of electropiale
 - a) mitromism on
- (b) protonated autrous and
- e) autrous será
- of future of
- e instructionister con-

Karata PET 2018

JEE (Advance) for HT Entrance

B74. In the reaction

$$H_{i_1}C^{i_1} \stackrel{N_{i_2}}{ } \stackrel{N_{i_3}}{ } \stackrel{N_{i_4}}{ } \stackrel{N_{i_4}}{ } \stackrel{N_{i_5}}{ }$$

the structure of the product 1 is

LIT 2010)

B75. The major product of the following reaction is

B76. Amongst the compounds given, the one that would form a brilliant coloured dye on treatment with NaNO₃ in di. HCI followed by addition to an alkaline solution of β -naphthol is

B77. In the reaction shown below, the major production formed select

B78. The major product of the reaction is

B79. In the following renchans the major product Wis

B80. The products of the following reaction sequence is are

eJEE Advance 2016.

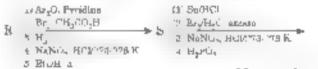
B81 The order of basisity among the following compounds is

GRE Advance 2017)

B82. The major product of the following reaction is

JEE Advance 2017)

883. Amiline reacts with mixed and Conno. HN: gendering HLS: , at 988 K to give P. 51%. Q. 47% and R. 5%. The major product is of the following reaction sequence a new



Major product, s

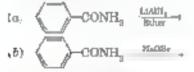
JEE Advance 2018,

MULTIPLE CHO CE QUESTIONS with piore than one correct answers

C1. Examine the following structures for antimum on and choose the correct statement from the following

NH.

- .c) Il is an acceptable canon cal structure because carbrainin ions are less stable than aminoming ime
- b) H is not an acceptable canonical structure because it.
- d) II is not acceptable conomical structure because the nitrogen has ten velence electrons
- II is an acceptable conomical structure.
- C#. A positive Carbylamine test is given by
 - a) N N- Dimethyl emiline
 - by : 4-Dunethy andme
 - c) N-Methyl-o-methyl andine
 - d) p-Methyl benzylamine
- Ca. Which of the following reactions form benzylenune?



- C4. Reaction of RCONH, with a masture of Br, and KOH gives RNH, as the main product. The intermediates involved in the reaction are
 - a) RCONHBr
- (5) R—NHBr.
- (e) E-N=C=0
- (e) ROONBe.
- C5. Which reagents among the following can affect the convention ?

 $CH_{\alpha}C = N$ + CH, CH, NH,

- (a) Ha, Pt
- (b) Ammunecti AgNO,
- .e) LaA.H.
- von NaBH,
- C6. Which of the following amines undergo acylation reaction 7
 - (a) CH_CH_NH,
- (h) C.H.NH.
- e) (CH_CH_6NH
- (d) (CH, ,, N
- C7. In which of the following amines, the first has lower pK_{\bullet} value shop the second ?
 - Aniluse, m-miro antine
 - 5 o Tuluidine p-toluidine
 - .c) Andine, p-chloroandine
 - (d) Andine p-aminophenol
- C8: 2X + B.H. > (BH., X). |+ (BH.,)

The aminets X 15/are

- (a) NH_a
- (b) CH,NH.
- (c) (CH, NH
- (d) CH, N (IJT 2009)
- Co. The raditation of benzene diagonium chloride to phonyl by frazine can be accomplished by
 - .a) SnCl., HCl
- (b) Na.80.
- (c) CH₂CH₂OH
- (d) H_aPO_a (WB JEE 2017)
- C10. The possible product(s) to be obtained from the reaction of oyelobutyl amma with HNO, 18/4rs

- H_C-CH, /WB JEE '018'

61 00 C3. b. d 64. a Ca. p . C5, a. (B. ,a, b) C10. (a, c,

Ca. a b. c 17 ac

MULTIPLE CHOICE QUESTIONS based on the given purrage/comprehension

Pansage I

Amanes are basic to nathers this to the presence of one pair of electrons on N atom of -NH₀ group. The basic strength of ammed can be expressed by their dissociation constant, K_a or pK_a

$$RNH_1 + H_0O + RNH_1^+ + OH^ K_b = \frac{RNH_1^+ OH^-}{RNH_1}$$
 and $pK_b = \log K_b$

Greater the K, value or smaller the rik, value more is the basic strength of simile. Aughstic similes are stronger bases. than ammoma due so the electron releasing effect of askylgroups. The basic strength among simules decreases as

Aryl amuses such as anning are less basic than abphabic aminea due to the involvement of inne pair of electrona on Nation with the resonance in benzene. In derivatives of aniline. the electron releasing groups increase the basic strength while electron withdrawing groups decrease the basic strength. The base weakening effect of electron withdrawing group and base strengthening effect of electron releasing group is more invided. nt p-position them at m-position. Every c- substituted nuline is less hame, but aculine due to netho effect.

Answer the following questions

DI Which of the following has lowest pK, value?

- D2. Which of the following statement is not correct?
 - n Ethylamina is more basic than anilina
 - σ -o-merliylandine has lower pK, we be than another
 - e' p-methylamine is less basic than we methylamine
 - d Ansline has lower pK, value than o-mirronniane
- DS. Memmani pK, value is of

D4. The atrongest base among the following in

D5. Which of the following group does not decrease the basic strength of sinding?

Раневаје П

Treatment of compound O with EMnO $_{\rm c}/{\rm H}^{+}$ gave P which on heating with ammonia gave Q. The compound Q on treatment with ${\rm Hr}_{\rm c}/{\rm NaOH}$ produced R. On atrong heating. Q gave S, which an further treatment with ethyl 2-bromopropanate in the presence of KOH followed by acidification, gave a compound T

Answer the following questions:

DS. The compound R is

D7 The compound T is

a givene

в віжите

c value

d series (wEE Advance 2016)

Assertion Reason Type Questions

The questions given below consist of an Assertion and a Renma. Jae die following key to choose the appropriate mawer

- to If both essertion and reason are CORRECT and reason is the CORRECT explanation of the nesertion.
- b) If both assertion and reason are CORRECT but reason is NoT THE CORRECT explanation of the assertion.
- sc. If assertion is CORRECT but reason is INCORRECT.
- of Hossertion is INCA RRECT but reason is N RRECT
- ie If both assertion and reason are INCORRECT
- Assertion. n-Propylamine : as inglier onling point than transflylamine

Reason Among a propylamine molecules, there is bydrogen bonding but there is no hydrogen bonding in trimethylamine.

- Assertion Ambine does not undergo Friedel Crafts reaction.
 Friedel Crafts reaction is an electrophilic aubstitution reaction.
- 3. Assertion. Anishe is a weaker base than ammonia.

 Reason Anishe is resonance stabilized.
- 4. Assertion. Carbylamme reaction involves the reaction between 1° among and chloroform in the presence of alkair.
 - Reason 1 In carbylumms reaction, NH₂ group changes to NC group

5.	Assertation:	Terkiery amines undergo scylation reschot.	8. Assertion	Sulphotabe and has high melting point and a
	Rennon	Tertiary amines have replaceable H atom		practically insoluble in water
6.	Assertion	Anume hydrogen stupbets, on beating forms a mature of orthology and a susmenliphonic tends.	Reason 0. Assertion	Sulphandic and exets as zwitter on salt Akyl eyemdes and alkyl languandes have
	Rennon +	The sulphon r and group is electron withdrawing group		much higher bound points than corres- ponding alkyl bandes
7	Assertions	Ammonotypis of alloy balides involves reaction	Reason	Cyanales and recovarides are much more polar than advel condes
	Reason ;	between alkyl natides and alcoholic simmonia. Ammonolysis of alkyl habdes manny produces	10. Assertion	p-mart au de la a stronger base than p-toluidue
		3° romones.	Reason c	The electron withdrawing NO2 group in p-introsonione makes it a stronger base
	1. (a) 2.	b' 8, b' 4, (a) 5, (s' 0,	b) 7, m)	B. (a) B. (a) 10. sp.

Matrix Match Type Questions

Each question contains statements given in two columns which have to be matched. Statements in Column is are abelted as A. H. C. and D. whereas statements in Column II are abelted as p. q. r and s. Match the entries of Column I with appropriate entries of Column is. Each entry in Column is may have one or more than one currect option from Column II. The maswers to these questions have to be appropriately bubbled as Mustinfed in the following example.

If the correct matches are A-q, A-r, B-p, B-s, C-r, C-s and D-q when the correctly subbled metrics $w = -\infty k$ ake the following

	P	9		8	
A	(P)	9	0	(3)	1
В	_	(1)	_	_	
С	0	(A)	0	(8)	
D	(P)	0	0	(8)	

1. Match the compounds in Column I with their properties resolving in Column II

	Column I		Column II
В	CH ₃ CH ₃ CH CN CH ₃ CH ₃ CH ₂ CH ₃ CH ₄	q	Reduction with Pd. CVH fladuction with Sm.1./H-1 Tevelopment of final smell on treatment with KOH and "HCL"
D	CH ₃ CH ₂ CH ₃ NH ₃	5	Recursion what descharyl aluminism sylvide DRAL-H Alkaline hydrotysis

 Match the reaction in column-I with product formed in column-II

	11.		
	Column-I		(-olumn-I
A	te biner phi binamide rendimo	p	Ha HaNHa
(B)	Reaction product of 15 amme	9	C ₆ H ₆ NH ₃
	with alcoholic R. H and "HC",		
C	Reaction product of ortrigen	*	C.H.CH.NH.
	correspond combound with		
D.	Reaction product of 1° autodes with Br _q and KOH	5	C.H.NC
ſ	with account in H. H. and "HC". Reaction product of intragen concerning compound with mAIH Reaction product of 1° annales	*	С ₆ Н ₆ СН ₄ ХН

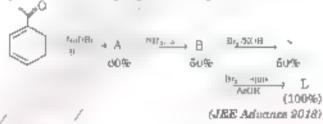
7.				
the Apaqst	B ps	" p	D r	
(3) A par	B 4	* p r	D p. q ar	

Integer Type or Numerical Value Type Questions

Integer Type: The answer to each of the following question is a single-digit-integer ranging from 0 to 9

- 1. The number of momeric amines corresponding to molecular formula C.H.N. which liberate N. gas on breatment with autrous word is
- 2. The number of amines having pK_{μ} less than $C_{\mu}H_{\mu}NH_{\nu}$ among the following to $p \cdot CH_a \cap_a H_a NH_a, o \cdot CH_a C_a H_a NH_a, m \cdot CH_a C_a H_a NH_a \cap_a H_a N$ CHa . CaHaNHCHa p-NO CaHaNHa p-ClOaHaNHa "H" H" NH"
- 3. The number of isomeric smines of formula C.H.N. baving a benzena ring is
- 4. The number of isomeric amones of molecular form the C.H., N which give carbylamine reaction is

- Total number of nitrogen atoms present in reduced product obtained by reducing introbenseus with LaA.H., followed by aqueous work up is
 - Numerical Value Type: Give the correct numerical value on decimal notation truncated/counded off to the second deramal nince)
- 6. In the following reaction sequence, the amount of D in g) formed from 10 motes of acetophenone is Atomic weights in g mai⁻¹ H = 1, C = 1..., N = 14. O = 16. Br = 80 'The yield '%) corresponding to the product in each step is given in the parenthesis.)





1. (9) 2, 16, 3, 5)

4 (8)

J. 31

6. 495.10



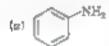
NUERT

Exemplar Problems



Objective Questions

- Which of the following is a 3° amine?
 - a methylaydoberylemine
 - Triethylanime
 - fert-buty-name
 - d) N-methylandine
- 2. The respect TUPAC usine for CH.= CHCH, NHCH, 10
 - Adylmethylenme
 - 5. 2-muno-4-pentene
 - 4-aminopent-1-ene
 - d N-melliylprop-2-en ⊥ amine
- 8. Amongst the following the strangest base in aqueous medium is
 - c CH,NH.
- A MOCH, NH.
- c CH, NH
- .d C₄H₆NHCH₄
- 4. Which of the following is the weakent Bronsted base?







d) CH,NH,

5. Benzylamine may be alkylated as shown in the following equetion

 $C_gH_gCH_gNH_g + R-X \rightarrow C_gH_gCH_gNHR$

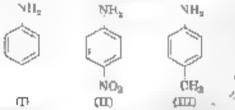
Which of the following askyl halide is best suited for this reaction through S_N1 mechanism?

- .a) CH, Br
- b) O,H,Br
- $r = C_n H_n O H_n B_n$
- d Call Br
- 6. Which of the following reagent would not be a good choice for reducing an aryl intro compound to an amine?

 - n) H₀(expecs)/Pt (b) LaA₂H₄ in ether
 - .c) Fe and HCl
- (d) So and HC!
- In order to prepare a 1° among from an alkyl hande with simultaneous addition of one CH, group in the carbon chain, the reagent used as supres of nitrogen is
 - a) Sudrum amide, NaNH.,
 - .b) Sodamn azade NaN.,
 - (c) Potassium cyamide, KCN
 - .d) Petassium phthelimids, C_aH_a(CO)_aN⁻K⁺

- 1 (5) 2. (cf)
- 9. (c
- d. (a
- 5. .c)
- 0. 16
- 7 -

- 8. The source of intropen in Gabriel synthesis of amines is
 - (a) Sodium raide, NaN.,
 - Sodium nitrite, NaNO
 - 'e' Patassium cyanida, KCN
 - d Potness in phthatimide, C_aH_a·CO_aN^aK[†]
- 2. Amongst the given set of reactants, the most appropriate fer preparing 2° amme is
 - (c) 2" R—Br + NH.
 - b) 2º R—Br + NaCN followed by H./Pt
 - el 1º R—NH₀ + RCHO followed by H_c/Pt
 - d) 1° R—Br 2 mor, + potassium phthalimide followed by H_O*/beet
- The best reagent for converting ?--phenylproparamide into 2-ођеоу/огорапалиле на
 - er errens H.
 - b) Br, io aqueous NeOH
 - c) iodine in the presence of red phosphorus
 - d) LaAIH, in other
- The best reagent for converting, 2-phenyl propanaoude into 1- phenylethenennos is
 - ,α) excess H./Pt
- (b) NnOH/Br_n
- e NaBH,/methanol
- .d) LtA.H./ether
- 12. Hoffmann bromannde degradation reaction is shown by
 - ,a) ArNH.,
- (6) ArCONH.
- e ArNO. Id: ArCH NH.
- The correct mersasing order of baun strength for the following compounds is



- σ .I ~ ... < I
- b all < l < II
- e H < H < I
- (d) II < 1 < III
- Methylamine reacts with HNO, to furm
 - $\sigma = CH_X + N = 0$
- b H₂ 40—(H₃
- e CH,OH
- $A = H_a \circ H$
- The gas evolved when methyleaume reacts with astrous actd is
 - d NH,
- 6 N.,
- (d) C₂H₆ '
- In the aitretion of benzene using a mixture of cone. H_oSO. and coac. HNO, the species which instrates the reaction

 - (a) NO_a
- (b) NO+
- .c NO;
- d NO.

- Reduction of aromatic autro compounds using Fe and HCI. aivee.
 - ectuso adminorar (a).
 - aromane hydrocarbon.
 - (c) aromatic primary amine
 - abuna sidamora do
- The most renotive name towards directs by drochtoric acid.

e) H₁C N CH₃



- 19. Acid anhydrides on reaction with primary annines give
 - di annie
- (b) usude
- (c) meondary amina
- (a) imme
- named as
- 20. The reaction Ar N2 Cl CarlCl + ArCl + N, + CoCl is

18. (6

- .c) Sandmeyer reaction
- 46 Cattermann reaction
- cl Clausen reaction.
- d) Carbylamine reaction.
- 21. Best method for preparing primary names from alkylhalides without changing the number of carbon atoms m the chain is
 - a Hoffmann Bromanude reaction
 - b Gabriel phthal-mule synthesis
 - ¿ Sandmeyer reaction
 - (d) Reaction with NH.,
- 22. Which of the following compound will not undergo axo coupling reaction with bonzene discontinu chloride
 - .c) Aniline
- 51 Phenot
- Альвоте
- do Nacrobengene
- 23. Which of the following compounds is the weakest Bronsted bese?

NH, NH,

24. Among the following amines the strongest Bronated base



(b) NH₃

(e) N

н

- (a) N
- The correct decreasing order of basic strength of the following species is

H₂r MH₃ OH: MH₃ o NH₄ > 2H: > NH₃ > H₄: b 2H: > NH₄ > H₄O > NH₄

b +H + NH_t + H₂O + NH₃

量6. .在

24. (1)

26. .b)

27. (c)

Multiple Cheice Questions (Type-II)

Note In the following questions two or more options may be correct.

28. Which of the following cannot be prepared by Saudineyer a reaction?

a Chlembearene

à Bromobenzene

Indohenzene

- d Fluorobenzene
- 29. Reduction of natrobenzene by which of the ollowing reagent gives and no?

a Sa/HCI

b Fe/HCI

c H. Pd

- d Sn/NH, "H
- 80. Which of the following species are involved in the partylemme test?
 - e R-NO
- & CHCL,
- .c) CDCL
- (d) NaNO_a + HCl
- 81. The reagents that can be used to convert benzeuediazonium chloride to becase are
 - a) BuCl_/HCl
- 🧢 😘, CH, CH, OH
- $c = H_{\eta} P \iota_{\eta_0}$
- of LateH,
- 32. The product of the following reaction in

 $NHCOCH_5$

+ Br_s/CH_sCOOH

- (c) $NH_0 > H_0O > NH_2 > OH$ (d' $H_0O > NH_3 > OH$ > NH_4
- 26. Which of the following should be most volatile?

d Hach Chanh, h ChanN

H CH,CH, NH IV CH,CH,CH,

(a II (c) I

6) IV

- 27. Which of the following methods of preparation of ammes will give some to more of carbon atoms in the chain of entires as to discrepantal?
 - (a) Reaction of marite with LiAiH.
 - (b) Reaction of smide with LtAIH, followed by treatment with water
 - Heating analyticalistic with potassium ask of phthalmude followed by hydrolysis.
 - d' Treatment of année with bromine in aqueous solution o sodinio hydroxide.
 - NHCOCH₃

 NHCOCH₃

 b

 Br



NECOCIE

(c) ar

- d Br
- 88. Aremus ion involved in the bromination of aniline is



(b) NH_R



.d H

- 84. Which of the following amines can be prepared by Gabriel synthesis.
 - g Leobutyl amine
- (b) 2-Phenylethylemine
- c) N-methylbenzylamana
- d) Anume
- 85. Which of the following reactions are correct?

- 20. Under which of the following reaction conditions, uniline gives p-rates derivative as the major product?
 - (a) Acetyl chiocide/pyridine followed by reaction with conc H₀SO_s + conc. HNO_s
 - (b) Aceto anhydride/pyndine followed by cone. H₂SO₄ + cone. HNO₂.
 - (c) Dil. HCl followed by reactions with cone. HLSO₄ + cone HNO₈.
 - (d) Resetum with cone HNO, + cone H, SO,
- 37. Which of the following reactions belong to electrophilic eromatic superintation?
 - to Brommetion of ecotemilide
 - (b) Coupling resotion of anyldiagonium salts
 - (c) Diazotustion of anime
 - (d) Acyleiden of aniline

84. (a , b)

35. 2), 2)

86. (0), 5

27. 6), (6)

----- Matching Type Questions



Note : Match the stems of Column I and Column II in the forewers greatenes.

 Match the reactions given in solumn I will be the statements given an "ordana I.

Column I	Commi II
attended of carbon atoms	" Amme with incher
(b) Gabriel phthaumide synthesis	at Detection test for promary
(c) Hoffmann Bromanuda reartou	(ni) Reaction of phthalimide and Ro X
(d) Carbylamme reaction with NH ₃ .	(+o, Reaction of alkylhalides

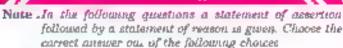
39. Match the compounds given in Column I with the items given in Column II

Column I	Column II
a Benzene sulphonyl chloride	r Zwider on
Susphumite and Adry' disconsum salts Aryl discommuni salts	Housberg reagent Dyes Conversion of alcohols

88. (a .m. (b) (m; (c) (n; d)-

89. a arb to a ab

- Resertion and Reason Type Questions-



to Both assertion and reason are wrong.

- Both assertion and reason are correct statements but reason is not correct explanation of assertion.
- (c) Assertion is correct statement but reason is wrong statement
- d) Both assertion and reason are correct statements and reason is correct explanation of assertion.
- te) Assertion is torong statement but reason is correct statement.

40. Assertion 1 Acylation of ammee gives a monocubatituted product whereas alkylation of amines gives polysubstituted product

Reason Acyl group stermally hinders the approach of further acyl groups

41. Assertion : Hoffmann bromainide reaction is given by primary amines

Reason Primary annues are more basic than accordary

- Assertion. N-Ethylbenzene sulphonanude is soluble in alloh. Reason Hydrogen attached to nitrogen in sulphonemide se atrongly acidic.
- 43. Assertion N. N. Diethylbonzene sulphonomyle is insolvible

Reason : Sulphonyl group attached to nitrogen atom is strong electron withdrawing group

44. Assertion. Only a small amount of HClus required in the reduction of nitro compounds with arm serep and HCl in the presence of steam.

Recent a FeCl, formed gets bydrulysed to release HCl during the reaction

 Assertion. Aromatic 1st amines can be prepared by Gabriel. phthahmide synthesia

Reason : Aryl nalides undergo nucleophilio substitution with amon formed by philamonide.

46. Assertion - Acstendade is less basic than ambine Reason t Acetylahou of aniline results in decrease of electron density on nitrogen.





Hints & Explanations for Difficult Objective Type Questions

A. mcg with only one correct answer

A2. (a. : Only primary ammee give carbylamine reaction.

AA
$$d' = C_0H_0NH_0 + C_0H_0CHO = + C_0H_0N = CHC_0H_0 + H_0C$$

Benzakiehyde Sciuffo base

A6. d'
$$NH_2 \xrightarrow{\text{Ning P2/P1}} 0 =$$

A12. b
$$(C_0H_{a^{1_0}}NH + HONO)$$
 $\Rightarrow (O_0H_{a^{1_0}}N \cdot N = O + F_0O)$

A13. c
$$\sim$$
 NH \sim is least base and therefore has maximum value of ρK_b

A15. b
$$CH_2CH_2NH_2 + CHCI_3 + \delta KOH alc.$$
 $+ CH_2CH_2NC + \delta KCI + 3H_2O$

A16.
$$d' = CH_5CONH_0 + Br_2 + 4 KOH + CH_5NH_0 + 2 KBr + K_5OO_5 + 2H_5O$$

A17 (b) :
$$Br_0 + 4KOH$$
 + $R_0 + 2KBr + K_0 CO_0 + 2H_0 CO_0$

A18. c RN1., +
$$S = C = S$$
 - RNH - $C = SH$ $\xrightarrow{Hell_2}$ R N - $C = S$ + HgS + 2HC1 Alleyl isothocyanata

A19 c Refer A.18. Phenyl mothiccyanate.

A28. b CH₂CHCH₂CH₂CH₄C2 Aminopartane

NH.,

A35. d' Sandmeyer's reachan with chimosophine gives p-dichlombenzene which is subd in p. 725 K while his with and in a chimide gives chimobenzene which is aquid in p. 405 K. Aminoum hydrochionde is an and salt and therefore, aberates CO, with NaHCO, and gives white pit of AgC with AgNO, However both are primary annues and give carbylanume test and therefore, cannot be distinguished.

A26. (a)
$$CH_sCH_sCH_s : H_sCN \xrightarrow{N_sH_s} H_sCH_sN \xrightarrow{T_s} : H_sCH_sN \xrightarrow{T_s} (H_s: H_sNH) \cap CH_s$$

- A20. α Primary amines form benzene sulphopamides which are soluble in alkalies
- A80. d) 1 Secondary smines can be prepared by reduction of asonitriles

$$R_{-}N_{-}N_{-} \stackrel{\text{def.}}{\longrightarrow} RNH^{-}M_{\alpha}$$
 isolatule $T_{-}A_{\text{timble}}$

A31. a Arometic diazomum selts are more stable then alignatic diazomum selts because of resonance

A32.
$$c$$
 N_2^*Cf $N_3^*HF_4^*$ F

A34. b $N^*=NCl+ OH$ $pl+ll-ll+ OH$
 $pl+ll-ll+ OH$
 $pl+ll-ll+ OH$
 $pl+ll-ll+ OH$
 $pl+ll-ll+ OH$
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A87. b
$$N^{+} = NCt + CH_{3} \xrightarrow{H \text{ pol} = 4.84} N = N - N = N CH_{3}$$

Jimediylanulma

A38. d t Electron releasing groups moreose the stability of discrimina calcone by theperang the positive charge on the Nestons.

$$\mathbf{A40.} \quad c \qquad \stackrel{\mathrm{NH}_2}{\Longrightarrow} \qquad \stackrel{\mathrm{NH}_2}{\Longrightarrow} \qquad \stackrel{\mathrm{NH}_2}{\Longrightarrow} \qquad \stackrel{\mathrm{NH}_2}{\Longrightarrow} \qquad \stackrel{\mathrm{NH}_2}{\Longrightarrow} \qquad \stackrel{\mathrm{Hr}}{\Longrightarrow} \qquad \stackrel{\mathrm{$$

B mcq from Competitive Examinations

B1. a Methylicocyanule on reduction with LaA.H., go as undeshylemana which is a secondary sinule.

B2. (c) :
$$NH_2 \xrightarrow{N \in NO_2} NH_3 \xrightarrow{N \in NO_2} N = N \xrightarrow{CH_3} NCH_3$$

B3. d Secondary aliphatic and aromatic emines react with natrous acid to form N-microscomine

B4. (b):
$$HNO_3 + H_3BO_4 + NO_3^+ + H_3O + HSO_4$$

Here HNO_3 tosse OH: to give NO_4^+ Herce it acts as a base.

B5. (c) :
$$CH_a \xrightarrow{C \leftarrow NH_2} \xrightarrow{NaNL_a} CH_aNH_a$$

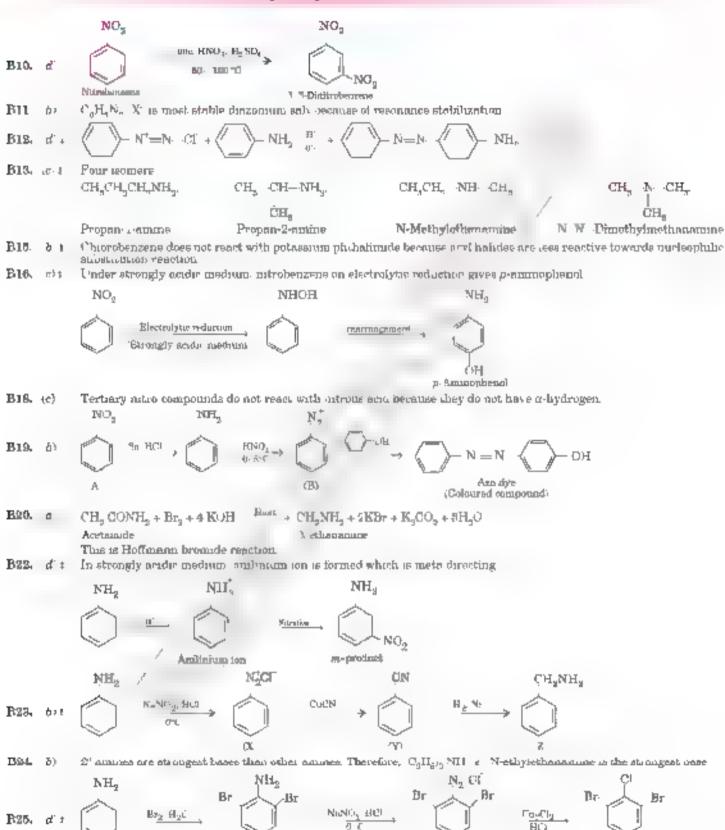
This reaction is Hoffmann degradation reaction.

B6. c
$$V_{2} = V_{2} $

Br

2, 4, 6-telbrono ohtonobenzene

Competition File



Ďг

Amilian

B27. (d): Secondary assumes could be prepared by reduction of isomitriles.

$$R-N=C$$
 $\xrightarrow{4|R|}$
 $RNHCH_{3}$
 $eec-Am.ne$

- B28. d' Gebriel phthalimide synthesis is used for the preparation of 1° aliphatic annues. Ethylmethylamine is a 2° anime and hence cannot be prepared by this method.
- **B20.** d Secondary annues disthylamme give an alkali madulile product with p-tulu-necallphonyl chloride.
- B30. b Cyclobexy amone is an auphotic amone Auphotic amone are more busic with promotic annues
- BOS. c CH₂CH₂NH₂ + CHCl₃ + SKOH—→ CH₂CH₂NC + SKCl + SH₂O This is Carbylanume reaction.

B33.
$$\sigma$$

$$NH_{3}$$

$$NH_{3}$$

$$NH_{3}$$

$$NH_{4}$$

$$N_{3}^{*}CI$$

$$N_{3}^{*}CI$$

$$N_{3}^{*}CI$$

$$N_{3}^{*}CI$$

$$N_{3}^{*}CI$$

$$N_{3}^{*}CI$$

$$N_{4}^{*}CI$$

$$N_{5}^{*}CI$$

Each CH_0 : C- group increases the molecular mass by 42 Total increase in molecular mass – 390 – 180 – 210

Number of NH_g groups
$$=\frac{210}{42} = 5$$

- **B86.** b. \bullet ($H_{a/a}$ WH as most basic and herofore has the smallest pK_a value
- B88. (d) : RCONH₂ + 4NaOH + Br₂ \rightarrow RNH₃ + Na₂CO₈ + 2NaBr + 2H₃O $_{-}$ e. 4 mole of NaOH and 1 male of Bc₂.
- B89. c Another in ecide ment on gets protonated to and norm on. Another no is strongly deactiveting group and is meta directing. Therefore meta nitration product is obtained in significant amount.
- B40. c The conjugate and obtained by addition of proton to another. C is stabilized by resonance and therefore it is most basic

The amme D'us secondary source and it is more best than primary amme A. The amme B is least basic because N atom in it is p^2 hybridised. Since a sp^2 hybridised N has more s-character, more electron egative—than sp^2 hybridised. N to amme A, then N is amme B has resser tendency to donate its electron pair than amme A. In other words, it is less basic than primary amme. A. Combining these breaks, the basicity of four ammes increases as:

$$B_c < A_0 < (D) < (C)$$

B41. a The precence of electron withdrawing group like NO, at p-position will decrease the basic character as ? will be least basic. Presence of electron donating group like A. H₃ at p-position with increase the basic character and therefore.
4 is the most basic. The order is

- B47. d' Primary aúphauc and aromatic primary amines give passave carbylanime cest μ-methylbenzylamine is a primary saune and benze gives this test

B50. b 2° amme reacts with benzene sniphor v' chronde and the product formed is insoluble in NaOH. Therefore, the amme should have only one H-atom attached to nitrogen atom.

B51
$$\sigma$$
 M_0NH_0
 The possible isomers are

(i)
$$(u)$$
 (u) $($

B52. (a. : Only primary amides undergo Hoffmann bromamide reaction.

B59. b
$$CH_3$$
 CH_3 CH_4 CH_5 CH_5

B54. (c) :
$$(C_0H_{h^20}NH + HONO + C_0H_{0^20}N \cdot N = O + H_0O + H_0O)$$

N·Nitrosociethylmmine

B55. c The conjugate sinds obtained by addition of proton in anime 4 is resonance standard by three equivalent structures. Ull and III while that obtained from anime 3 is resonance stabilized by two equivalent structures. IV and V

Therefore among 4 is more basic than since 3. In since a_{N} ione pair of electrons is present on a sp^{0} hybridized N while in since 2. It is present on a sp^{0} hybridized N. Since a sp^{0} ophransed N are unite s-character times electronegate e^{s} than a sp^{0} hybridized N. derefore among 2 has lesser tendency to time e^{s} electron pair han since 1. In other words among (2 is less basic than among 1) combining base words the basicity of four among acrosses as

B56. (c) Only premary alighetic amuse can be prepared by Salmel phthat made synchesis. Therefore, benzylamine is prepared by this method.

B57. (a)
$$CH_3$$
 CH_4 CH_5 CH_5 CH_5 CH_5 CH_5 CH_5 $COOH$ $COOH$

Ethane nitrile A) 8 NHCH. NO. NHL NO Reduction hotustinii B59. (a Mitmibeogege Attition Paperty1 N-Methyl skindviktinše bedsenadboe θ

B60. (c) Primary aliphatic and remarks animes react with CHCL, in the presence of alread KCH and give isocyanides which have necessing amel/odour

 $PhNH_{2} = \frac{CHCl_{2}}{alc KOH} \Rightarrow PhNC (Phenyl inoryamide)$

B61. . : Hybridisation of N is the compounds are

$$H_{a}C = CH_{a}$$
 $CH_{a} CH_{a}$
 Sp^{2}
 Sp^{2}
 Sp^{2}

As percentage of s-character increases the electronogeticity increases. Therefore, electronogeticity order as $MeCN > C_cH_cN > Me_cN$



B67. A.

B68. (c) :
$$NH_2$$
 $N\equiv N$

CHUI₁/Mr-SEOH

Hant

Prenylimcyanide

B85. p N. N. Dimethylamine 3° amine forms p-netroso cerivative with HNO,

a 'b and c) are not correct

0-1

Ortho substituted sudures are weaker bases than others due to ortho effect, which is combination of steme and electronic factors.

B68. b Problem can be solved by long back reprison. Hoffmann degradation reaction. Bc, NaOH converts another to number cone number atom less.

CRIGANIC COMPOUNDS CONTAINING NITROGEN

B70. (d) : Benrylamine is most basic among these.

B71. (b) :
$$N^{+} = NOf + NH$$
, $N^{+} = NOf + NH$, $N^{+} = NH$. Sequence diagrams theoretic Aniliane $N^{+} = NH$, $N^{+} = NH$. $N^{+} = NH$

Aromator tertiary annue $x \in \mathbb{N}$ N-dimethylandine undergoes electropic substitution with nurosimum on at p-position of the phenyl ring.

B73. 0 F
$$\longrightarrow$$
 No. 2 $\xrightarrow{\text{CH}_3 \times \text{NB}}$ $\xrightarrow{\text{CH}_3}$ No. \longrightarrow No. 2 $\xrightarrow{\text{CH}_4 \times \text{N}}$ $\xrightarrow{\text{CH}_4 \times \text{N}}$

During the stands of Br. $\langle \cdot \rangle$ $\langle \cdot \rangle$ $\langle \cdot \rangle$ C.—Br cond is shorter due to resonance and hence is strong. Therefore it resonant take part in the reaction. The CI takes part in the reaction.

B76. c
$$H_{3}C$$
 N_{1} N_{2} N_{2} N_{3} N_{4} N_{5} N_{5

Acetylintum values place when amone and amode reacts with acetylich mode or aretic aphydride

Maan product

Resonance with two NH, groups increases electron density out N of \pm NH.

Resonance with one NH, group currences electron density of N to lesser extent, than IVI of -NH. Electron density on N of NH increases due to resonance

The lone pair is not available because it is involved in aromatic sextet Ш

Hence, oursect order is IV > I > II > III

CRIGANIC COMPOUNDS CONTAINING NITROGEN

A.

C. meg with more than one correct answer

C8.
$$(a,b,c)$$
; $2NH_9 + B_9H_9 \rightarrow \begin{bmatrix} H & NH_5 \\ H & NH_5 \end{bmatrix}^+_{NH_9}$

Similarly it forms some compounds with a and 2' amuses. But with 3' amuses, it forms adduct

D mcq based on the given passage/comprehension

$$D\theta_{s, ch} = \begin{cases} P_{s, ch} \\ P$$

Matrix Match Type Questions

Apqs, a

$$CH_{0}CH_{2}CH_{2}(N \xrightarrow{Pd-C} CH_{0}CH_{2}CH_{2}CH_{2}NH_{2}$$

$$\xrightarrow{BoGl_{1}} CJ_{1}CH_{2}CHO + NH_{4}CI$$

$$\xrightarrow{DIBAL+H} CH_{2}CH_{2}CH_{2}CH_{2}CH_{2}NH_{2}$$

$$\xrightarrow{DIBAL+H} CH_{2}CH_{2}CH_{2}CH_{2}COOH + NH_{8}$$

$$E p = 0$$

$$CH_{3}CH_{2}OCOCH_{3} \xrightarrow{Pd-C} 2CH_{3}CH_{4}OH$$

$$\xrightarrow{AJIIAL-I_{2}} 2CH_{3}CH_{4}OH$$

$$\xrightarrow{DIBAL-I_{3}} 2CH_{3}CH_{2}OH$$

Integer Type or Numerical Value Type Questions

1. (2 Leomente amines are

Only primary amine (i.e. 20) react with HNO, to liberate N_g gas.

2. 5 The animal p-CH₁C₀H₂NH₄, m-CH₂C₀H₃NH₄ C₀H₀N CH₂m-C₀H₀NHCH₃, C₀H₂CH₂NH₂ are more basic than animal and hence have lower pH₂ values

 There are eight conserve amines of motecular formula. H. N. Out of chose only three are primary which give carby lamine reaction.

th 495 J(r)
$$\xrightarrow{\text{Neath}}$$
 $\xrightarrow{\text{Ning}}$ $\xrightarrow{\text$

ORGANIC COMPOUNDS CONTAINING NITROGEN

Moles of A formed
$$\frac{20 \times 60}{100}$$
 \rightarrow 0 and

Moles of B formed
$$=$$
 $\frac{8 \times 56}{100}$ \Rightarrow $\frac{3 \text{ mol}}{100}$

Moles of C formed
$$=$$
 $\frac{3 \times 50}{100}$ \Rightarrow 1.5 mal

Males of D formed
$$=$$
 1.5×100 \rightarrow 1.5 mal

Amount of D formed =
$$330 \times 1.5 = 495.90g$$

NCERT Exemplar Problems : MCQs Type-I

- 4, α Due to detocable too of a tone pair of electrons present on the Nestoni into the benzene ring, C_kH_kNH, as a weak base
- 5. (c) because of the stability of C,H,CH,* parbocation.
- B. (d) C₀H₄(CO), NTK

· Phengil propanamide

9-Phonyl propagation-

1.
$$b$$
 CH₂CH CONH₃ $\xrightarrow{N_3 \text{OH}}$ CH₂—CH—NH₃ \dot{C}_3 H₅ \dot{C}_4 H₅

13. d' Esectron donating group ($-CH_{h^2}$ norsesses the basicity of amines while electron withdrawing group $-NO_{h}$ decreases the bancity

10. (c)
$$NO_3^+$$
 is an electrophile. /
 $HNO_3 + H_2SO_3 \rightarrow NO_3^+ + HSO_3 + H_2O_3$

18. (b) The amone which is most basic is most reactive, i.e. (CH₃), NH.

- 22. d) Nitrobenzene does not undergo azo coupling reaction
- 26. (b) (CH_{g/g}N ..e. tertainy amone does not form sasomated molecules

NCERT Exemplar Problems . MCQs Type-II

- 29. $\alpha \in b = c = C_0 H_5 N O_0 \xrightarrow{Z_{B_1} NH_2 \Omega H} C_0 H_5 N H O H$ while all other reagents give arrange
- (a). (b) Detha and pare products are formed.
- 24. (a). (b) Only primary sliphetic amines are prepared by Gabriel synthesia



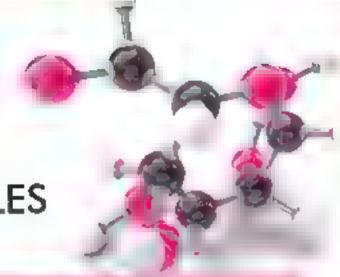


Time Allowed 2 Hrs.	/ Moxemum Marks 26
1. We set the ILPA \ nome of () - (2H - N - (
1 Write the IUPAN name of O-CH,—N-O-CH,	1
2 Arrange the following in order of their basic strength in aqueo	n strike eu
andine p-nitroaniune, p-toluidine	1
9 How will you convert andme into chlorobenzene? Give equation	r 1
4 Why do ammes act as nucleophiles?	, " / 1,
5. Aniline dissolves in equeous HCl. Why?	í í
6. Emplain.	
. Why loss the reactivity of NH, group get reduced in nor-	tons ade?
. Why lose methylamnie has lower browng point toar in the	
7 Convert the following	-
(a) 3-Methylamane to 3-astrotoluene	
(a) Andre into 1, 3, 5-tribromobenzene.	'2.
8 What is Sabriet phthabinide synthesis? Why arong the primary	
9 How do accusate and acquisate primary another react with man	
.0. Why are aromain ammes weaker bases than amphan ammes!	
.1 How will you convert	
 Benzyl chroride to 2-phecylethanan ne q An 	ane to p-bromonname
(ni) Benzoic acid to aniline?	E,
Explain the following reactions by giving one example	
	ndmeyer's reaction
,41) Bazz-Schiemann reaction	(9,
.9. Explain the following	
(a) Ethylamine is soluble in water, whereas aniline is not.	
 A.though ammo group as — dy-tracting in aromatic electric 	rophile substitution reactions, and reaction
gives a substantial amount of m-astroamline	101
(c) Amline does not undergo Frade: Crafts reaction.	(3)
14. Convert the following	
a) 4-Nitrotomene to 2-bromobenzoic acid	
(a) p-tolaidine into 2-bromo-4-methylanihne	g.
 ati) acetaldehyde to ethylamine. Starting with a al. one trong suitable reagents, outline the s 	8. R lo esentrou
	trobenzene C
(tt) 1, 2, 9-tribromobenzene	
16. (a How does benezone diazonium chloride react with	
souline ii. landq (a)	
b) Describe the method for the identification of primary secondary.	and sertany accures. Also were electrical equations for
the reactions involved.	δ

► To check your performance see HINTS AND SOLUTIONS TO SOME QUESTIONS at the end of Part II of the book



BIOMOLECULES



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Conceptual Questions 30, 49

CHAPTER SUMMARY & QUICK CHAPTER ROUND UP

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60

PP

but highly organised form. These are caused biomolecules. Thus, biomolecules are the complex titeless molecules which build up bying organisms and are required for their growth maintenance and ability to reproduce. These form the basis of life. Some common examples are carbohydrates, proteins, enzymes, nucleic acids, lipids, amino acids, tats, etc. These biomolecules interact with each other and constitute the molecular logic of life processes. The branch of science which deals with the study of biomolecules and their role in living systems in called biochemistry.

These biomolecules interact with each other in a specific manner to produce life. Many of these biomotecutes are polymers. For example starch, proteins, nucleic acids are condensation polymers of simple sugars, aim no acids and nucleotides respectively in addition, some simple molecules like vitamins and mineral salts also play an important role in the functions of organisms.

CARBOHYDRATES

Carbohydrales are a class of naturally occurring organic compounds of carbon, hydrogen and oxygen which are primarily produced by plants. These are formed in plants by a process known as photosynthesis and make up about 70% of the soud plant materia.

$$xCO_2 + yH_2O \xrightarrow{\text{Statisght}} C_x(H_2O)_y + xO_2$$

83

87

- The sugar that we most commonly use is called sucrose and
- The sugar present in milk is known as loctose.
- The common examples are glucose, fructose, cellulose, sucrose, starch, etr

In the earlier days, the carbohydrates were regarded as the hydrates of carbon with the general forming $C_kH_kO_{ij}$. For example, carbon yourses such as glarges $C_0H_iO_0$, fructions $C_0H_{ij}O_0$ sucrose $C_0H_iO_1$ satisfied this definition. However this definition could not hold good due to the following reasons.

- (z, A number of compounds such as rhamnose $(C_0H_{12}O_0)$, decryribose $C_0H_{12}O_4$, etc. are known which are corbodydrotes by their chemical believiour but do not obey this formula.
- a. There are other compounds also forms achyde. CH.... scetar and $C_1H_4\cup\ldots$ etc. which do not behave like carbohydrates but have the formula of hydrates of carbon.

.tt. Carbon is not known to form hydrates.

A large number of their reactions have shown that these contain proylly large adelyties, polyhydric ke ones and large belomers at istances which can be broken down to polyhydric aldebynes or ketones. Therefore, these days carbohydrates are defined as

optically delive polyhydroxy aldehydes or polyhydroxy kelones or the compounds which produce such compounds on hydrolysis.

Some of the carbohydrares, which are sweet in taste, are also called **sugars.** The most common sugar in two use is named as sucress and sugar present a mak is known as lactose. The early 1 ydrates are also called **succharides** (Greek Sakcharon meaning sugar).

Classification of Carbohydrates

Carbohydrates, in general, may be classified into two classes

- (i) Sugars. These are crystalline substances which are sweet and water soluble. For example, glucose, fructose and cane sugar.
- 1) Non-sugars. These are tastesess, asomble a water and amorphous. For example, starch, relialose, etc.

However, here laye carbonydrates are systematically classified into three principal classes

Monosaccharides. These are the simplest carbohydrates which cannot be hydroxysed into simpler compounds. Therefore, they represent the simplest single rarbohydrate units. About 20 monosaccharides occur naturally. They compare up to six carbon stoms. They have the general formula. H₁ where n=3-7. The common examples are indose. $^{1}{}_{3}\mathrm{H}_{10}\mathrm{O}_{3}$ giveose $\mathrm{C}_{6}\mathrm{H}_{12}\mathrm{O}_{6}$ fructose $\mathrm{C}_{6}\mathrm{H}_{10}\mathrm{O}_{6}$, etc.

- · Oligosaccharides. These are the carbohvarates which give two to ben monosoccumide molecules on hydrotysis. These are further classified as disaccharides. Insaccharides, 'etrasaccharides, etc. depending upon the number of monosaccharide units present in their molecules. For example,
- Disaccharides Carbohydrates which or hydrolysis give two molecules of the same or different monosaccharides. For example, sucrose, nations, All these have the molecular formula $C_{12}H_{22}O_{11}$
- Trisacobaride Carbohydrates which on hydrotysis give three molecules of the same or different monosaccharides. For example, raffinose $C_a H_{ac} C_{ac}$.
- Tetrasacobarides: Carbonydrates which on hydrolysis give four moternies of the same or different monosarchandes. For example, stachyose $(C_{n_d}H_{de}O_{eq})$.
- in, **Polysacobarides.** These are carbohydrates which are polymeric and can be hydrolysed to give a large number of monosaccharide units. The common examples are callulose starch giyoogen, etc. The general formula of starch and calculose is $C_8H_{10}O_{5\ell\eta}$. These get hydrolysed to give monosaccharides.
- In general, monosacchandes and of gosaccharides are crystaline solids, solidle in water and awest in tasts.
 Therefore, these are collectively called sugars.
- Polyancchardes are amorphous, insoluble in water and asstelless and are, therefore, known as non-sugars.

MONOSACCHARIDES

Monosarchandes are polyhydric aidehydes and ketones which cannot be hydrolysed into simpler carbohydrates. The monosarchandes are classified as:

- (i) Aldoses. The monosacchamdes containing an aldehyde r CHC group are called aldoses. This group (CHC is always present at one end of the carbon chain, i.e., at C_{r}
- (ii) **Ketoses.** The monosacchandes containing a keta f/C = O group are called **ketoses**. In al. naturally occurring ketoses keto group is present at a carbon next to the terminal carbon, i.e., at C_o .

They are further classified as traces, tetroses, pentoses, heroses heptoses, etc depending upon the number of carbon atoms they contain. Therefore, while naming these mono saccharides, the prefix indicering the number of carbon atoms like tetra 4+ pento 5 hero 6 hepto-(7) etc is incorporated in the term aldose or ketose. For example, an atdopentose means that it is an aldehydic carbohydrate containing five carbon atoms. Similarly ketoherose means a ketane containing aix carbon atoms.

The common monosaccharides are given in Table 1

Pable 1 Monosacchandes

No. of Carbon aloms	Cliran	Molecular formula	Structural formula	Examples
			Aldores	
3	Aidotriores	$C_aH_aO_a$	СН-ОНСНОНСНО /	Glyceraidehyde
4	Aldotetroses	$C_dH_gO_d$	СН,ОН/СНОРФ,СНО	Brythrone, Threense
B	Aldopentoses	$C_{\hat{n}}H_{\hat{n}\hat{n}}C_{\hat{n}}$	CH OH CHOHE, GHC	Arabinose, Ribose, Xylose, Lyvose
O.	Ardoheroses	$C_gH_{12}O_g$	СН.ОН-СНОЮ _С НО	Glucose, Calo tose Manage, Allose
				Talose, Gutose, Idose, etc
7	Aidaheptases	$C_2H_MO_7$	CH _s OH/CHOH) _s CHO	
			Keloses	
3	Ketotnoses	$C_3H_8C_3$	CH ORCO, CH OH	Dihydrasyacetone
긮	Ketotetroses	$C_4H_8O_4$	СЫ ОН СОЛСНОН СИЗОН	Erythrulose
ō	Кетерет опев	$C_6H_{16}D_6$	СИ,ОН СОЛСИОН "СИ,ОН	Returbour Xyornose
в	Ketohexoses	$C_{\theta}H_{\phi}G_{\theta}$	CH OH COC BOH & HOH	Fruciose Sorbose, Tagatase Psicase
7	Ketoheptores	$U_{n}H_{N}O_{n}$	СН,ОНСО/СНОН, ДН,ОН	

Most of the monosacchamdes icrir in nature. They are colourless, crystaline souds, soluble in water indicave awert taste. These are quite stable and do not get hydrolysed. They char on healing giving characteristic smell. They are optically active.

Structures of Monosaccharides

The amplies monosarcherides are trioses such as glyceroldehyde and dihydroxyocrtone both having the molecular formula $C_8H_{8^{1/3}}$. The glyceroldehyde is althree white thhydroxyocetone is ketose as shown below

SHO	CH,OH
Н—С—ОН	ė=0
CH,OH	CH _a OH
Nyreroldehyde	Гарунтахулсегане

The most well-known monoseccharides are ribose $C_8H_{10}O_8$ glucose $C_8H_{10}O_8$ Ribose is aldopenose glucose is aldohexose while fructose is ketchexose as abown below

D- and L- Designations

The sugars are divided into two families—the *D-family* and *L-family* which have definite configurations. These configurations are represented with respect to glycoroldelityde as the standard. The glycoroldelityde may be presented by two forms as.

The D-configuration has the Attached to the carbon adjacent to the carbon adjacent to the carbon adjacent to the carbon adjacent to the CH attached to the carbon adjacent to the CH at left. The sugars are called D- or L-depending upon whether the configuration of the molecule is related to D-glyceraldehyde or L-glyceraldehyde.

It has been found that all naturally occurring sugare belong to D-series e.g., D-glucose, D-ribose and D-fructose.

However it may be noted that D and L do not represent dextrurotatory or inevariatory. The optical activity of the molecule is represented by + old — which represent the direction of rotation of plane polarized light whether dextrurotatory or inevariatory.

is assigned D-configuration of the OH group attached to the carbon adjucent to the CH₂OH group (last chiral carbon) is on the right hand side irrespective of the position of other groups. On the other hand, the molecule is assigned L-configuration of the OH group attached to the carbon adjacent to the CH₂OH group is on the left.

▶ The letter D-or L-carboby drates represents configuration.

By convention, a molecule

The carbon atoms of an aldose are numbered starting from the adebyde group (—... H.O., and that of ketose from that end which is closest to the ketomic group.

-OH group attached to sast chiral C atom is projected to the RIGHT

Presence of Asymmetric Carbon Atoms

On carefully examining the monosacchande molecules, we observe that they contain one or more chiral carbon atoms. For example, glucose has four chiral carbon atoms to as carbons 2.3.4 and 5. We know that if there are a chiral carbon atoms in a molecule, it will have 2º optical sumers. Therefore, glicose has 2º or statical optical isomers. Three of these existeen a lobexoses which occur Diglicose, Digalactose and Dimanaose.

It may be noted in all these three molecules, the configuration at 2-5 is same (. OH on the right) and, therefore, they belong to D-florily

Olavore

Glucose occurs in nature in free as well as in the combined form. It is present in sweet fruits and honey. Ripe grapes contain about 20% of glucose and that is why it is 7,50 known as grape sugar. In the combines form, glucose are as in abundance in case sugar and polysacchandes such as starch and cellulose.

Preparation of Glucose

From Sucrose (Cane sugar)

When sucrose is boiled with dulute HCi or H.SO, in sicoholic solution, glucose and fructose are obtained in equal amounts.

$$C_{12}H_{22}O_{11} + H_{1}O \xrightarrow{B^{+}} C_{0}H_{12}O_{0} + C_{0}H_{12}O_{0}$$

Sucreee sucree Fractice

2. From Starch

Glucose is produced commercially by the hydrolysis of starch by boiling it with dilute H.SO₂ at 393 K under pressure of 2-8 atm.

$$C_8H_{10}C_8J_n + nH_2C \xrightarrow{E^+} MC_8H_{12}C_8$$
Starch Givens

In this process, an aqueous solution of starch obtained from corn is acidified with d_{ij} H_iSD_{ij} . It is then heated under 2. 8 atm pressure steam in an intercave. When the hydrogens is complete, the hound is no itrained with sodium carbonate to a pH of 4–5. The resulting solution is concentrated under reduced pressure to get the crystals of glucose.

Most naturally occurring sugars are of the D-series with the Highest Hight Hindown Highest Highest Highest Highest Highest Highest Highest Hig

Structure of glucose

Gi rease is an aldohexose. It is also known an dextrose it is monomer of many of the larger carbohydrates such as attach glycogen cellulose etc. It is probably the most abundant compound on the earth. It has one aldehyde group. CHOO, one primary alcohold group. CHOO and four secondary alcohold groups y CHOO). Its structure may be written as

оно	one aldebydac group
фион ,	Four 2º airo, lie groupa
жен	one 1º alcoholac group

This structure was assigned on the mais of the following evidences

1. Molecular formula

The molecular formula of glucose has been found to be $C_6H_{12}O_6$

2. Stroight chain structure

When squeous solution or glucuse is treated with solution smalgam. Na/Hg
or sodi its corollydride is in reducers at sorbir or in glucitol, a nexalty are absolute.

СНО
$$CH_2OH$$
 CH_2OH CH_2OH CH_2OH CH_2OH CH_2OH CH_2OH COH

n Prolonged heating with hydrodic said and red phosphorus at 100°C gives a mixture of n-hexane and 2-nodohexane.

$$CH_2 \rightarrow CHOH_4CHO$$

Gracese

 $CH_3 \cdot CH_3 \cdot CH_4 \cdot CH_5 + CH_3CH \cdot CH_5

The formation of a hexage suggests that all the six carbon atoms in glucose are arranged in a straight chain structure of glucose

Presence of five hydroxyl .-OH) groups

Acetylation. Glucose reacts with archic anhydrone in the presence of anhydrone zinc chioride to form glucose pentagretate or penta acetyl glucose. This is known as acetylation of glucose.

The formation of penta-acetyl derivative confirms the presence of five. OH groups in glucose molecuse. We know that the presence of two or more in groups on the same carbon atom makes the molecule unstable. Now, since glucose exists as a stable compound, this shows that five the groups should be attached to different carbon atoms.

4. Presence of an aldehyde (-CHO) group

G. Ronotton with hydrogen eyanide. Like aidehydes, glucose rearts with hydrogen eyanide forming eyanidydnin.

(ii) Action with hydroxylamine. Glucose reacts with hydroxylamine NH₂OH to form glucose oxune.

These reactions suggest that glucose contains a carbonyl (>C=O) group.

6. Oxidation of glucose. The oxidation of glucose occurs as:

. Glucose gets exidused to six carbon carboxylic send glucome and on reaction with a mild exidusing agent, the brownine water. This narroles that the carbonyl group is present as an aldehydic (-CHO, group.

CHO CHOH
$$_4$$
 + [D] $\xrightarrow{B_{02}, H_2O}$ CHOH $_4$ CH₂OH Ch₂OH

Since glucose is readily oxidised, it acts as a strong reducing agent and reduces To let a reagent animometer, at ver retrate, and Februag solution.

Strong randsong ages to the union and oxidise both the terminal groups. THO and CH. of glucose to give the dibasic and, ascebanc and (also known as glucose. This indicates the presence of a primary atrohology. OH) group in glucose.

RU Carleus...

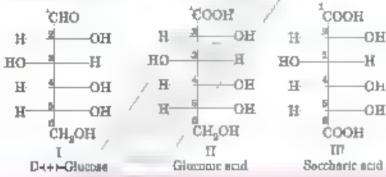


- Why is glucose given to patients under exhaustion.
- Glucuse is an initiant source of energy and therefore is given to patients under exhaustion.

Gi reome send obtained by the outdation of glucose with Br_{α} H_{α}O also gets axidised with nature and to glucosis axid (see charic and).

It may be noted that in glucose, the OH group at C_a chiral curbon a unented towards left while the remaining three—OH groups at C_g , C_4 and C_5 chiral carbon atoms are oriented towards right.

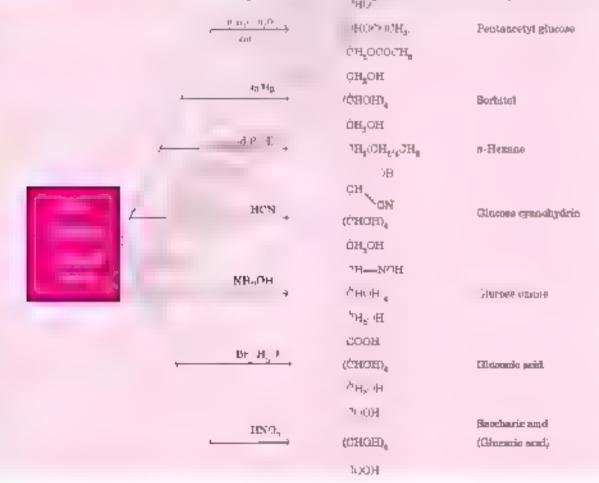
On the mass of a love reactions. Fischer assigned an open chain structure of glucose shown below as structure I. Simmarly, gondone and is represented as II and saccharic acid as III.



Surces is correctly unused to Ih + glarose P before the unuse of glarose represents the configuration as already fluctuated whereas + represents dextracolatory ascure of the molecule.

BUM UP

The important reactions of glucose are summed up as



Learning Plus.

Reactions with phenyl hydrazine : Osazone formation.

Aucuse rearts with phenyl hydrazine like normal aidebydes to form pheny, bydrazone. However, unlike normal aldebydes, glucose on warming with excess of the reagent gives deplenyl hydrazones called osazones.

It was been observed that during the reaction, three equivalents of the reagent are consumed but the product consumed only two , theny hydrazone residues. It was been found for other the formation of phenyl hydrazone. It was been found for other the formation of phenyl hydrazone. It was adjacent. Choose group is conducted by a second phenyl hydrazone molecule to carbonyl group and and itself as reduced to antime and ammonia. Phenyl hydrazone of gracose. If the a produced reacts with phenyl hydrazone to form glucosezone.

Glacosszone is a yellow crystal, ne soud compound, sparingly soluble in water and has a sharp metting point. It is used in the identification of glucose.

In the reaction of glucosezone both to and Co are converted to phenyl hydrazone. Therefore is ketose assogives the same osszone as its related aldose.

Thus, J an autose and ketose forms the same essagne, they have the same structure at all carbons except C_1 and C_2 . For example, glucose and fructuse form the same essagne.

Cyclic Structure of D-Glacose

The open chain structure of glucose explained most of its properties. However, it could not explain the following facts.

- 1 Despite having an aldehydic CHO group, glucore does not undergo certain characteristic reactions of aldehydes. For example.
- a Mucose does not react with sedium bisinpliste. NaHSU $_{g}$ to form addition product,
 - b) Glucose does not react with ammonia.
 - Glucose does not give Schiff's test and 2.4-DNP test like other aldehydes.
- 2 Glucose reacts with hydroxylamine (-NH₂OH) to form an exime but glucose pentageetate does not react with hydroxylamine. This shows that —CHO group is not present in glucose pentageetate.
- 3. B*+**-Glucose exists in two stereorsomerar forms i.e., a-D-glucose and \$-D-glucose. These we forms are crystal me and lawe different melt, ig por around optical rotations. When glucose was crystal are from a concentrated solution of 303 K it gave reform of glucose having melting ment 419 K or 146°C and $\alpha l_0 = + .1.°$ On the other hand, the β -form of glucose is obtained on crystal sation of glucose from a not saturated solution at a set perature above 37. K. The β -form of glucose has melting point 423 K (or 150°C) and $|\alpha l_0| = + 10.2°$
- 4 Mutarotation. When either of the two forms of glucose to P-glucose and β-D-glucose are dissolved in water and allowed to stand, these get slowly converted into other form and a eq. 1 or an unxture of both α-P-gh case about 96%) and β-D-glucose tabout 64%) is formed

The formation of equilibrium mixture can be explained as

The α -D-glucose has a specific rotation of +111° while β -D-glucose has a specific rotation of 10.0° When α form is discolved in water, its specific rotation fans until a constant value of +52.5° is reached. In the other hand, when β -form a discolved in water its specific rotation increases and recomes constant at +52.5°

This spontaneous change in specific rotation of an optically active compound with time to an equilibrium value is called mutarotation. (Latin, muto means to change).

Thus, there is an equilibrium mixture of α- and β-forms in the solution.

$$\alpha$$
-D-(+)-glucose \Longrightarrow Equilibrium mixture \Longrightarrow β -D-(+)-glucose $\alpha_b^{2896} = +.11^o$ $\alpha_b^{2896} = +52.6^o$ $\alpha_b^{2896} = +10.2^o$

5. Glucose forms isometric methyl glucosides. When glucose is heated with methanol in the presence of dry by larger, chaori is gas, it gives two assument monomethyl derivatives known as methyl α-D-glucoside in ρ. = 438 K or 165°C, and methyl β-D-glucoside in ρ. = 380 K or 107°C.

$$C_aH_{12}O_a + CH_2OH \xrightarrow{BO} (C_aH_{11}O_a)OCH_a + H_aO$$
Glucosa

Methyl u- and
 β -glucoside

These two glucosides do not reduce Felling's solution and also do not react with hydroger eyamide or hydroxy amine indicating that the free CHO group is not present.

Since only one molecule of methanol is used for the formation of methyl glucoside, these must be hemiscetais. These results show that glucose does not have open chair form structure. Like glucose, the open chair structures of other monosarchanides relicises and ketoses, show similar limitations.

Cyclic Structures of Monosaccharides

The monosaccharates give the characteristic reactions of alcohols and carbonyl group antehyaes and ketones. It was been found that these monosaccharates exist in the form of cyclic structures. We know that aldehydes

and ketones react with the hydroxyl group to form hemiscetals and acetals, as

Monosaccharides contain a number of . OH groups and an aldehyde or a keto group. Therefore, they can undergo meanwhiteman reaction, within the motecule to form hemiocenals which result in cyclic structures. In cyclication, the . OH groups generally of C_5 or C_4 in adoses and C_5 or C_6 in ketoses combine with the adiabyte or keto groups. As a result ryche structures of five or six membered rings containing the oxygen atom are formed. For example, glurose forms a ring structure. It forms a six membered ring of five carbon atoms and one oxygen atom.

Cyclic Structure of Glucose

Anomor

Charost forms a hominectal between the CHO group and the \odot H group on the C_3 atom. As a result, of cyclication C_1 becomes asymmetric character the newly formed. (H group may be either on the left or on the right in Fracher projection formable. This results in the formation of two somers which differ in the orientation of H and. OH groups around C_1 atom. These isomers are known as α -D-glucose and β -D-glucose

The isomer having the hydroxy, group. OH on the right is on ed a U-guicose and the somer having the hydroxy, group. OH on the off-is called 6-Digiticose.

Such pairs of optical isomers which differ in the configuration only around C, alon are called anomers.

These two forms are not murror images of each other and, hence, are not enanthement These corbon is known as anomero earbon or also each on a

The above represents this is to led Fischer projection formulae. The formation of two methyl glucosides by reaction of glucose with methanol can be explained as

REMEMBER

- In &-D gluense, the OH group on C₁ is on right and
- m β-D glucose, the OH group on C, is on left

Such pairs of optical isomers which differ in the configuration only around C₁ arom are called anomers.

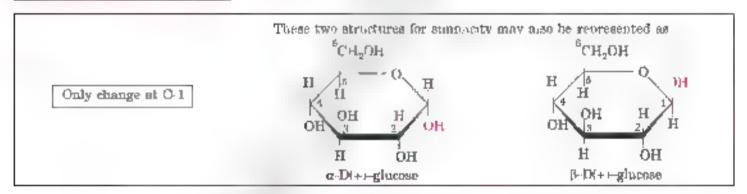
O Structure of pyran

Pyranose Structures

The structures of α-D-glucose and β-L-glucose may be drawn in a simple six membered ring form called **pyranose structures**. These resemble **pyran** which is a six membered heterocyclic ring containing five carbon stoms and one oxygen stom. These structures were suggested by Haworth and are known as **Haworth projection formulas or pyranose structures**.

- Groups on the right in a Pischer projection are down in a Hawarth projection and
- Groups on the left in a Pischer projection are up in a Haworth projection

To write pyrenose structure for any monosecchemide α- and β-D-glucose,, draw a hexagon with its coygen atom at the upper right hand corner. The terminal -CH_CH group is always placed above, he place of the bezagon ring or D-serves. Place at the groups or C = C, and the wind are present in the left land side in Fischer projection copy. A plane of the ring and at those groups on the right hand side below the pione of the ring.



Fractuse (Fruit sugar CgH₁₂Og

Fructose focuse in fruits and is called **fruit sugar**. It is also weeent, a honey and sweet fruits alongwith glicose. In the combined state, it is the present in disaccheride (sucrose) and polysaccheride (multiple).

It is obtained alongwith glucose by hydrolysis of rane sugar with driute $H_{\nu}SO_{\mu}$.

The solution baving equal molecules of L glucose and D-fractose is called invert sugar

Structure of Fractose

Open structure of D=c=Fructore

Cyclic Structure

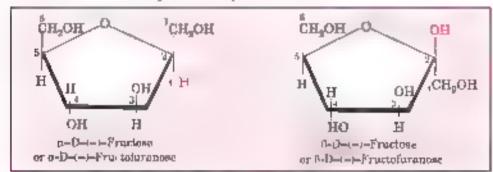
Like glucose, fructose also has a cyclic structure. The hermanetal is formed by the intramolecular combination of C_0 keto group and C_0 . Off group of C_0 atom. As a result, C_0 of on becomes asymmetric and therefore. Defructose has two possible lampers and C_0 in intractose and C_0 in infractose which differ in the arrangement of C_0 . He and C_0 if these are shown below:

The above structures may be written in the Hawarth forms as pyranose ring structures as

α-D-(·)-Fractors or α-D-(·)-Fractopyramose / β-D-(·)-Fractors or β-D-(·)-Fractopyramose

In the free state, D-fractors exists as a six membered ring or as pyranose ring. However, in the combined state as a component of disaccharides, it exists in the **furanose form** (3-membered hemiketal. This structure is similar to furan ring which is a five membered heterocyclic ring with one oxygen atom. The furanose structure can be obtained by internal ketal formation by combining keta group of G_n and $-\Theta H$ group of G_n as shown below

These structures may also be represented as



These cyclic structures for other monosaccharides can also be written in the same way as for glucose.

D.SACCHARIDES

Disaccharides are the carbohydrates which on hydrolysis give two same ar different monosaccharides. Their general armula is $C_1 H_{\rm ej} O_{11}$. The important members belonging to disaccharides are success masses and access. On by brolysis with disact acids or enzymes these give the following two molecules of monosaccharides.

The describerates are made up of two molecules of monosaccharides linked to each other by the coodensation reachon. The anking is formed just as hemiscetate react with appelous a form ocetal with the elimination of a water molecule.

In a summer way, the hydroxyl groups of hemiscetals of two monoscenhande unus condense to form disacthande. The two monosacthande unus are linked to such other through exyger; atom by a bond called **glycosidic linkage**. Let us discuss these briefly

1 Sucrose

It is the most common describende and is widely histmonted in plants particularly sugar case and sugar bee. It is manufactured either from case sugar or sugar beet. The sugar obtained from sugar beet is critical beet sugar, it is a comurless crystaliane and sweet substance. It is very soluble in water and to aqueous solution is dextropolatory having $id_{\rm ID} = +66.6^{\circ}$. On hydrolysis with the across or enzyme, invertisse, case sugar gives equimolar mixture of D-4++-glucose and D-4--fructose.

So, sucrose is dextrorotatory but after hydrolysis gives dextrorotatory glucose and laevorotatory fractose $D \rightarrow -$ fractose has a greater specific rotation than $D \rightarrow ++$ glucose. Therefore the resultant solution upon hydrolysis is is evorotatory in nature with specific rotation of $> 36.9^\circ$. Since there is thange in the sign of rotation from dextro before hydrolysis to laevo after hydrolysis, the reaction is called inversion reaction and the mixture glucose and fractose is called invertising.

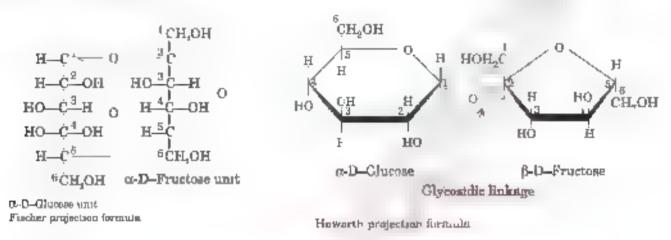
The .nkage between two monosaccharide units through mayen about is called glycomidic linkage.

Bectera present in the mouth take on enzyme which converts sources into a polysaccheride caused dextron. About 10% of deutal plaque is composed of dextran. That is why dentiate caution you not to eat candy.

Sucrose sortion is fermed ted by yeast when the enzyme invertise hydrolyses the sucrose to glucose and fractose and enzyme zymase converts these monosarchandes to ethanol (ethyl alcohol).

Structure

Surrose is composed of D-g) case and β -D-fructone. These units are held together by α , β -glycosidic hiskage between C of the glacose and β granose ring, and C_2 of the fructone unit furanose ring. This structure was proposed by Hawarth, 1927.



 C_{α} of a-glucose unit is finked to C_{α} of β -fractose unit.

2. Multipee

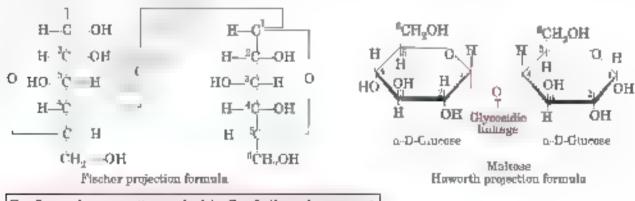
It is known as mart sugar. It is the principal desirement depotamed by the partial hydrolysis of starch by diastase an ensyme present in mail: appointed barley seeds.

$$2(C_0H_{10}O_0)_n + nH_0O \xrightarrow{Doublanc} nC_{10}H_{22}O_{11}$$

Starch Maltons

Structure

On hydrolysis, one mole of maltone gives two moles of α -D-glucose. It is a reducing sugar of is composed of two α -D-glucose axis, which are condensed together shrough C of one unit and C_q of the other unit. Both glucose axis are in pyranose form



C_1 of one glucose unit is lanked to C_4 of other glucose unit.

3. Lactose

Lactoss occurs in mak and, therefore, it is also called malk sugar-

Structure

Lactose on hydrolysis with dilute acid gives equimolar mixture of β -D-glucose and β -D-galactose. It is a reducing sugar. Therefore, it is composed of β -D-glucose and β -D-galactose units. These units are held together by glycosidic unkage between C_1 of galactose and C_2 of the glucose unit.

Lactose geta hydroysed by emilian an enzyme which apenfically hydrolyses β-glycosidie – akages.

C, of galactose is linked to C, of glucose umf.

Reducing and non-reducing sugars

Reducing augura. The sacchandes which reduce Fehling's solution and Tollen's reagent are called reducing augurs. The reducing augurs contain groups which can be easi'v oudsed by Fehling solution or Tollen's reagent For example, they outsin the following characteristic groups

Reducing sugars contain, comydroxyaldehyde or comydroxy ketone groups



0-Hydroxy aldehyde group

u-Hydroxyketone group
 ceta or remiketal groups

Reducing sugare contain cyclic hemiaceta, or nemiketal groups. Its aqueous solutions these hemiacetals or hemiketals exist in equilibrium with relatively small concentration of non-cyclic aldehydes or ot-hydroxy ketones. Angla free. CFO or CFO group.

Hemiscetal Hemiketa

Non-reducing sugars. The sarchandes which do not reduce Februar's solution or Tollen's reagent are called non-reducing sugars.

These do not contain free aidebydic or ketonic group with. CH group on the carbon adjacent to carbony group. They contain stable oceta, or keta, structures. Then cyclic structures cannot be opened into an open chain form having a free carbonyl group.

Examples. All monosarchandes contain free CHO or C=0 group and are reducing sugars. For example, D-glucose or D-fructose.

Among the insaccharides maltose and lactose are reducing sugars because none of the monosaccharide inits there is a hemiosetal group that cut be opened to give free. CHO group, Sucrose is non-reducing because the reducing groups of glocose and frictions are involved in glycosi fir band formation.

Sugar and Sweetness

The monosecohar des and describendes have sweet toste and, therefore, they are called sugars. The degree of sweetness, however yames as shown below.

Sugar	Relative sweetness
Lactose	18
Mrdtnee	32
Galactose	32
Gluross	74
Socrose	100
Frantone	178

Assertant from the table, fructors as the aweetest of all the natural sugars.

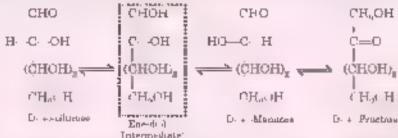
However it may be inted which as sudition to carbonydrates, some other chemical compounds are also very mores. For example

- Socchara used se artificial sweetner is about 500 times as sweet as sucrose
- (i) The protein manufelin is about 2000 times sweeter then sucress
- (iii) The peptide aspartame is about 160 times sweeter than sucrose.

Learning Plus

Action of aikakes on manassocharides Labry de Bruyn van Ekenstein Rearrangement.

When glucose is treated with a concentrated solution of an alkan at first turns yellow then brown and financy a brown resinous mass is formed. However, when treated with a ditme solution of an alkan. I undergoes a series of reversible kero-and traitomenzation reactions to form an equivalential must are of D-glucose. D-maintess and D-fructose. The temperagement mikes place through a 2-continuous. This reaction is called Lobry de Bruyn van Ekens, rin rearrangement. For example, when a solution of D-glucose containing column hydroxide is allowed to stand for several days, an equilibrium mixture of D-glucose. D-maintage and D-fructose is obtained as shown below.



It may be noted that the same equilibrium markers to obtained even if one starts with D++ markers or D++ for close

POLYBAUCHARIDES

These are neutral polymeric compounds in which hundreds or even thousands of monosaccharide and are juined by glycosidic altages. They have the general formula $(C_0H_{10}O_0)_n$, where a has very large value. They are colourless, tasteless and are loss—ble in water. The play very imports at role in plant and animal life as food storage and structural role. They are isually made up of peritoses or hexoses. The important polysaccharides are cellulose, starch, glycogen and destrins.

However, starch and cell lose are most import intofit is polysarcharides.

Starch (amylum), (C_AH₁₀O_A),

It is the main storage polysaccharide of plants. It is an important dietary source for human beings. It occurs in plants, particularly in their seeds roots tubers etc. The main sources are wheat, rice maize, potatoes, barley and sorghum. It occurs in the form of grant area, which vary in size and shape depending upon their plant source. Sixted is a white powder, ment big in cold water.

Its solution gives three school with notice solution. The blue colour disappears on heating and reordears on cooling. Starch is hydrolysed with thirte ands or enzymes and weaks down to molecules of variable complexity (n > n') and finally gives Digitarise.

$$(C_6H_{10}O_5)_n \longrightarrow (C_8H_{10}O_{5/n}) \longrightarrow C_{12}H_{22}O_{11} \longrightarrow C_0H_{12}O_6$$

Starch $n < n$ Mo cose D-G ucose

Starch is a non-reducing special defende. It lives not reduce Febbogis solution or Tollen's reagent. It also does not form an assistant indicating that a lineaceta, hydroxyl groups of glurose units are not free but are linked with glycoside linkages.

Starch is a polymer of a-D-gaucese and consists of two components, water soil it is component amylose 15-20%, and white need the component amylopeotin ,80-85%).

RU Cariota,...



- Frustose contains a ketonic group, yet it reduces Fehling's solution and Tollen's reagent.
- Fructose mithough contains a keto group, yet it acts as a reducing augur and reduces Feliung's solution and Tollens reagen. This is because in afkaline solution fructuse noderques a complex series of reactions that tead to isomerizations known as Lobry de Bruyu van Ekenstein rearrangement forming glucose end mannose. As a result, it is m equilibrium with a mixture of glucuse and mannuse. Since both almose and mannes contain -CHO proup therefore it probably reduces To len a reagent and Ferming solument.

REMEMBER

- A monosoccuar des are redoring sugara e.g. glumae forcuse
- Mahose and inclose are reducing sugare
- Sucrose is a min reducing sugar.

Sucrose is a non-reducing and is not readily unidiced as a reducing sugar. Therefore, it is much more useful for preserving foods such as jams and jelies. A reducing sugar fike glucuse would oxidise and spot the food.

 ℓ_{i} Amylose. It is a water soluble fraction. It is a linear polymer of α -D-glucose it contains about 200–1000 to D-glucose up to which are liked to one another through α -glycoside unkage lavolving C_{i} of the glucose and C_{i} of the next as shown below

Amylose

C, of one glucose unit is linked to C, of next glucose unit.

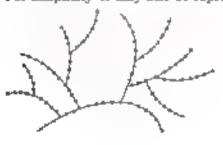
Its morecular mass can range from 10,000 to 500,000.

Amylopestin. It is water manuable fraction. It is a highly branched chain polymer which does not give blue colour with todine. It consists of a large number several hundreds of short that a of 25–30 D glucose units. In this case, the main chain involves analogues between C_1 of one a D-glucose unit and C_4 of the other. The C_1 of terminally branched chain is further linked to C_6 of the other glucose unit in the next chain through $C_1 = \frac{1}{6}$ a linkage. This gives highly branched structure

Amylopeetus

 \mathbf{C}_1 of one glucose unit is linked to \mathbf{C}_4 of other glucose unit. \mathbf{C}_4 of terminal glucose unit is inked to \mathbf{C}_6 of other glucose unit. Thus chain is formed by $\mathbb{C} + \mathbb{C}_4$ glycosidic ankage and branching occurs by $\mathbf{C}_3 \cdot \mathbf{C}_6$ glycosidic linkage.

For simplicity it may also be represented as shown below



Representation of branched chain structure of anylopectin

esch • represents a glucose unit

BIOMOLECUAES 14/15

Starch is used as the principal food storage of glucose energy. It is hydrolysed by enzyme amylese present in solive. The end product is glucose which is an essential nutrien.

2, Cellulose (C₈H₁₀O_{5/n}

It is also major structural polysaccharide in higher plants where it constitutes the bulk of cell wall. It is probably the most abundant organic substance found in plant kingdom. Over 50% of the total organic matter in the living world is cellulose. Dry leaves contain 10-20% cellulose, wood contains 50% and cotton contains 90% cellulose Cellulose forms the fibrous component of plant cell walls Cell dose does not reduce Fething solution or Tolien's reagent. It does not form osazone and is not fermented by yeast. It is not hydrolysed so readily as starch, but on heating with dilute sulphume and under pressure gives D-glucose.

Structurary cellulose is a straight chain polysaction is composed of in y \$-D-gincose units, which are joined by \$-glycosidic linkages between C of one glucose unit and \$-4 of the next glucose unit. The chains are arranged

to form bundles and are held together by hydrogen bonds between g-arose nots of adjacent strands. Its molecular mass π in the range of 5° 48 500,000 about 300-2500 D-giurose units.

Cellulose is an industrially important compound. It finds uses w textiles paper and plastic industries. When treated with a wide variety of chemicale, it forms many useful products celluloid, rayon, gue cotton an explosive cellulose acetate plastics and wrapping films), methyl cellulose fabric sizing, pastes and disametics), etayl cellulose (plastic costs and films), etc.

Digestion of Cellulose

Cell adjute barteric present in the stomach crusim. of a minancinal algrazing animals e.g. cow buffalo, deer sheep, etc break down relluiose with the help of enzyme cellulase. It is then digested and converted into glucose. Therefore, grazing animals can use relluiose of grass and plants as food by converting them into glucose.

Glycogen (C₆H₁₀O₆₁₀

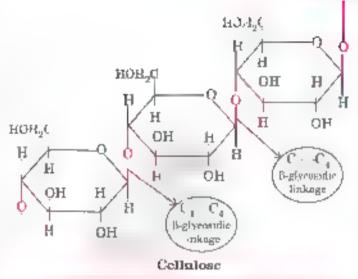
Glycogen is a polysaccharide of a D-g case. The carbonydrates are stored in animal body as glycogen. Just as glucose is stored in plants as starch, it is stored as glycogen in liver injuscles and brain of human beings, it serves as a reserve carbohydrate. When the Jody needs glipose during strenous exercise or fasting, the enzymes threak down glycogen so provide glucose. Glycogen is also present in yeast and finego.

Structurally glycogen is a condensation polymer of 6-D-glucose. It is known as animal starch ressure a surjecture is similar 6 sinylopectin. The only difference between glycogen and amylopectin is that amylopectin chains consist of 20–25 glucose units but glycogen chains are shorter because they consist of 10–14 glucose units. Glycogen is more linguity branched than amylopectin.

IMPORTANT FUNCTIONS OF CARBOHYDRATES

The important functions of carbohydrates are

- Carbohydrates are essential for life in both plants and animals. They
 form a major portion of our food. Honey has been used for a long time as an
 instant source of energy by 'Vaids' in syurvedic system of medicines.
- Carbohydrates with the exception of reliables work as body facts and act as the main source of energy. For example, alow cadabon of glucose by



of one glucose unit is maked to C_q of next

R U Carleus...



- Why is cellulose and digestible?
- The enzyme celluless can hydrolyse cellulose into glucose and bence can digest cellulose. However human stomach does not have any enzyme capable of breaking cellulose molecules and therefore, cannot digest cellulose.

Malisah Teat-

It is used for the detection of carbohydrates monosaccharides disaccharides or polysoccharides. To a 2 oil of squeous earbohydrate solution in a test tube add 2-3 drops of alcoholic solution. Now add 1 oil of come sulphune and along he sides of the test tube. A violet ring in formed at the junction of two liquids. This is a general test for carbohydrates.

REMEMBER

- ATP à adenosire triphéephase.
- ATP is an energy rich router to and acts as a source of energy
- ATP note as the centre of all activities of cell.
- During synthesis of I moter to of glucose in photosynthesis
 16 molecules of ATP are consumed.

RU Curinou...



- Carbohydrates are reserve food materials.
- Starch is the major food reserve at plants. It is started in seeds and note on reserve from material for tany plants to they are capable of making heir own food by photosymmetric Stationary givengen stant in miscles and liver arts as the reserve food material in animals in raise of omergency caused by failing or observe the hierglyregenic readily hydrolysed to glurose, which in turn gets midised in the blood to provide the much needed energy.

a series of steps provides energy for living organisms

$$C_8H_{12}O_9 + 6O_9$$
 + $6CO_9 + 6H_2O + Energy$

Potysaccharides first undergo hydrolysis to give glucose which then supplies the energy. Starch and sugars get hydrolysed to glucose by the enzymes present in the various junes secreted by different organs to the namen and animal digestive systems.

- 8 The corbohydroles act as storage of energy for the functioning of turing organisms. In case of emergency like increase function, they supply energy Sturch is major food reserve in plants and glycogen in animals.
- 4. They form structural materials for cens. For example, cellulose is present in the cell walls of the plant ce^{i} s
- 5 Carbohydrales provide au n'atenais for many important industries such as textues, papers, racquers breweries, etc.
- 8. The monosacrhandes D-whose and 2-deaxy-D-mbose are present in nucleic acids. These nucleic scids control the transmission of hereditary effects from one generation to another and also biosynthesis of proteins.
- I The more suchandembose is an essential compound of adenoune triphosphate ATP which acts as energy currency of the cells during metabolism of carbohydrates, proteins and fats. It is called energy currency of the cells because a part of chemical energy obtained by the condition of biomolecules such as carbohydrates, lipids etc. is stored in the cells in the form of ATP which in turn carries out all the cellular functions.



O

C

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A

Conceptual Questions =1=

Q.1. Why are carbohydrates generally optically active?

Ans. Parbohydrates are generally optically active because they have one or more chiral carbon atoms.

Q.2. How do anomers differ from epimers?

Ans. Corbohydrates which differ in configuration at the glycosidic carbon—e. C_1 in aldoses and C_2 in ketases—are called **anomers**. The cariohydrates which differ in configuration at any asymmetric corbon atom once than glycosidic carbon are called **epimers**. For example in-D-glucose and β -D-glucose are anomers differ at C_2 glycosidic carbon—on the their hand, glucose and mannose are epimers differ in configuration at C_2 .

Q.3. What are the polysaccharides that make up starch and what is the difference between them ?

Ans. Starch is a polymer of ta-glucose it consists of two components, amylose and amylopectar. Amylose is water soluble fraction and is a interest polymer of ta-glucose. Amylopectar is water manuable fraction which emissis of branched clients of ta-glucose.

Q.4. Is a diet consisting mainly of rice an adequate diet? Why or why not?

Ans. Adequate and good quality food is necessary for the physical and mental development. This food provides is energy for our daily work. Notestions food should content corbohydrates, face proteins and intermine. Rice alone counts supply these nutrients. Therefore, a diet mainly of rice is not adequate diet.

Q.6. Amylose and cellulose are both straight chains polysacobarides containing only D-glurose units. What is the structural difference between the two 7

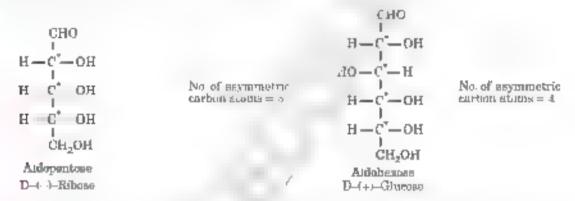
- Ans. Amylese a n straight chann polyanezherede having I-gluese ands jouned together by 0-glyensidae inkages areolysis C₁ of one gluence unit and C₃ of the read gluence unit. On the other hand, calculate a straight channe polyacechande having I-gracese mats jouned by 6-glyensulae makages between C₁ of one gluence and and C₄ of the next gluence unit.
- Q.S. What are reducing and non-reducing engage? What is the structural feature characterising reducing sugars?

 (Meghalaya S.B. 2015)
- Ans. Sugars which can reduce Toller's reagent or Februag's solution are called reducing sugers. The sugars which donot reduce Toller's reagent or Februag solution are called non-reducing sugars.

The characteristic structural feature of reducing sugars is the presence of oither whydroxy inidehydic group. It is the seach as glucose mannose, galactose, etc or whydroxy keto group. If the H inspresent in fractose

OH

- Q.7. Draw open chain structure of an aldopentose and aldohexose. Predict the number of asymmetric carbon atoms present in each.
- Ans. The open chara structures of an aldopentose and aldohexose are



Q.9 What is meant by toversion of sugar ?

- CBSE Sample Paper 2011, Pb. S.B. 2017)
- Ans. The change of specific rotation of sugar from dectro rotatory to inevolventary is called inversion of sugar
- Q.9 Glucose does not give 2, 4-DNP test and Schiff's test. Why ?
- *CBSE Sample Paper 2011
- Ans. Throse has a cycle structure in which H1 group is not free because it forms a harmonetal linkage with H1 group at 12-5. Therefore, it does not grid 2, 4-1 NP wet authorigh in line H1 group
- Q.10 Write any two reactions of glucose which could not be explained by open chain structure of glucose molecule. (D.S.H. 2012)
- Ans. Open chain structure of glacose molecule cannot explain the following
 - discuss does not renot with endictin braidplate. NaHS \cup_n to form addition product, hough it has aldebytic group.
 - (ii) Glucose does not give Schiffs test and 2.4-DNP test also other aldehydes
- Q.11 Write a reaction which shows that all the carbon atoms in glucose are in a straight chain.
- Ana. When glurose in lested with HI and red P at 1.00°C for a long period it gives a fiexane and to 2-induberane

$$\text{CH}_{2}\text{OH}(\text{CHOH})_{1}\text{CHO} \xrightarrow{\text{red} P \text{ scot} C} \text{CH}_{2}\text{CH}_{2}\text{CH}_{2}\text{CH}_{3}\text{CH}_{3}\text{CH}_{3} + \text{CH}_{5}\text{CHCH}_{2}\text{CH}_{2}\text{CH}_{5}$$

Nucona n Hexane I 2-Indoharane

The formation or a became suggests that all the six carbon atoms in glucose are arranged in a streight chain.

- Q.12 What is the name given to the linkage which holds together monosaccharide units in polysaccharides? Ans. Glycoside mixage
- Q.18 Give one example each of disancharide and polysacoharide.

(Jharkhand S.B. 2018)

Ans Dissertante Sucrose $\cdot \cdot \cdot \cdot H_{22}$. Polysaccharade Starch, $(C_4H_{20}O_6)_a$

- Q.14 What are the products of hydrolysis of sucrose?
- 'Hr S.B. 2012, Assam S.B. 2012, A.I.S.B. 2014,

- Ans. Cluctuse and fructose
- Q.15 What are the products of hydrolysis of increse?

'Hr. S.B. 2012, A.I S.B. 2014:

- Ans. Glucose and galactose
- Q.16 Name the disaccharide present in milk.
- Ans Lartess.

Q.17. Write the product when B-glucose reacts with conc. $\mathrm{HNO}_{\mathrm{g}^{+}}$

(A.I.S.B. 2018)

PROTEINS

Proteins are high molecular mass complex biomolecules of amino acids present in all living cells. The chie source of proteins are milk, cheese, pulses peanuts, fish meat, etc. They occur in every part of the body and form the fundamenta makes of atmeture and functions of life. The name proteins is derived from the Greek wire proteins which means primary or of prime importants. These are so immed here we proteins are a talchemical enhances essential for growth and have manned if for They are present almost in all the living cells of plants and animals. The protoplesm of plant or animal cells contains 10–20% proteins. The important proteins required for our body are

- enzymer as biocatalysts to catalyse biochemical reactions,
- hormones to regulate various body functions,
- · carbodies to protect he body against toxic substances and infections.
- frameport professe: to carry different substances in the blood to various tissues of the body
- structural proteins, auructura, elements of the cells and tissues,
- contractile proteins is the experimental of muscles and other cells etc.

All proteins contain the elements carbon, hydrogen, oxygen, introgen and sulphur Some of these may also contain phosphorus, todine and traces of metals such as iron, copper mac, manganese, etc

All proteins on partial hydrolysis give peptides of varying molecular masses which on complete hydrolysis give α-ammo acids.

Thus, chemically proteins are condensation polymers (polyamides) in which the monomer units are (t-amon acids.

AMINO AS ADS

(t-Amino acids are building blocks of proteins. Amino acids are organic rom, would conto a ng both an amino group and carbony, group. They are represented by the general form do

The animo—NH, group may be attached to any carbon at in: other than most of carbonyl (—COOH group. They are referred to so at β , y depending apon whether the smino group is present on a β or y carbon atom relative to carbonyl group. Nearly at the naturally occurring amino acids are alternative acids, i.e., containing amino group on the a (adjacent) carbon atom to carbonyl group. The general structure of atomino acids shown above. These amino acids are very important because these are the building bricks of proteins which are very essential for as

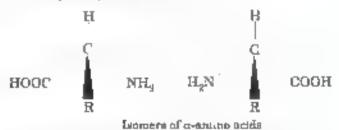
REMEMBER

- If the NH, group at the dural carbon free on the left hand side on in L-(-)-glyceroldehyde, the amino and belongs to L-series and
- u'it is towards night as in D-(+)glyceraidehyde it is said to
 belong to D-series.

14/23

L-Family of Amino Acids

With the exception of glycine, an other themino and above chiral carbon atom and have two optionals active isomers.



However all naturally occurring amino acids belong to L-series which have WH₀ group on the left as OH group in L-glyceraldehyde

Nomenclature of Ammo Acids

Although are no seeds can be named according to H PAC system, they are generally known by their common names or trivial names. For example NH,CH,COOH is better known as glycine rather if an incuman architectual or 2-amino ethanoic and. The trivial names are increased enter from the name of the source is the name of some characteristic property of that animo and. For example, glycine is so named because it has sweet lasts in greek glykos means sweet) and tyrosize was first obtained from chaese in lineak tyrosize was first obtained from chaese in lineak tyrosize means chaese in

For the sake of simplicity each annulo and has been given an abbreviation which generally consists of the first there effects or one letter symbols of become name. For example, we appear α-ammo and is given a NH, TH, COOH, it may be abbreviated as the Sometimes one effect symbols are also used. For example, glycine is represented by G. Similarly manne CH₂CH, NH₂COOH may be represented as Ala or A.

Classification of a-Amino acids—Neutral, acidic or basic amino acids

Amino acids can be broadly classified as acidio, basic, or neutral amino acids depending upon the relative number of amino and carboxy- groups in their molecules.

Neutral amino acids contain equal number of amino and carboxyl groups. For example, amino acids such as glycine, alanine, value, etc. are neutral amino acids.

Acidic amino acida contain more number of carboxyl groups than amino groups. For example, aspartic acid. glutanni acid which contain two. COOH groups and one. NH_n group are acidic amino acids.

Evidence for the Existence of Dipular ions. The full awing facts support the existence of dipular ions both in the solid form and in aqueous solutions of amino acids

te Amano and a are non-volatile crystalline solids with fairly high melting points. For example, glycine has m.p. of 262°C. The high melting points of commo acide suggest large intermilecular forces to the crystalla which are due to the electrostatic totaractions of the dipolar tons.

(#) Aqueous entations of rusing acids active alice entations of substances anying high dipole moments

(a) Like rome compounds, they are usolable in non-point organic solvents like bearing, petroleum ether or ether but are highly soluble in polar solvents like water

the Archity and basenty constants are very low for -COOH and -NH₂ group For example, glyone has K₁ = 1.6 × 10⁻¹⁰ and K₂ = 2.6 × 10⁻¹⁰ whereas must carboxylic acads have K₂ values of about 10⁻¹ and most aliphatic ammes have K₃ values of about 10⁻¹. Thus, is because in the ammost death of and and -COO group acts as an and and -COO group acts as the

or Examination of glycone prystais by X-rays above that it has the structure NH₄+CH₂OOO in the solid state

All above facts support that annua acide have dipoler ion structure.

Basic amino ocids contain more number of amino groups than carboxyl groups. For example, lysine orginine, and histodine which contain two NH₀ groups and one. COOH groups are basic amino acids.

The structures of 20 amino acids are given in Table 2 ahead.

Essential and non-essential amino acids

Certain animo acida can be made by our bodies and, therefore, we do not require them in our diet. These are called **non-assential animo acids**. The human body can synthesise 10 out of 30 amino acids found in proteins. Therefore, other in 1st be supposed at our diet and these are of field essential amino acids. The 16 essential amino acids are value, learned isole of the regional lysine threonine, methionine phenylalanine trypiophia, and castidine. These essential amino acids are required for the growth of our hody and lack of these essential animo acids in diet can cause diseases such as *kwashiorkor*.

PROPERTIES AND STRUCTURE OF AMING ACIDS

Physical Properties of α-Amino acids

Amno scide are usually colourless, crystalline solids. These are soluble in water and have high melting hourts. Therefore, they behave like an is rather than simple amnes or carboxylic scide. This behaviour is due to the presence of both acider and amno group in the same nationale. Therefore, the amno scidenast as dipola for called a **switter ion**. It has positive as well as negative ends within the same molecule. In the formation of switter ion, the proton goes from the carboxyligroup to the amnor group. The switter ion structure of common acid may be well as

The intomar structure as also called **internal sait**. All assume acids exist targely in dipolar teme forms.

Acutic and basic character of smino acids according to dipolar ion structure:

On the cases of Appolar ion structure, the acidic and basic reactions of amino acids may be represented as

• When the solution of animo and is made and/or an and is added to animo and, "COO" accepts the proton and gets converted to carboxyl solutional (—COOH). Therefore, the basic character is due to "COO" group.

When an a ker is added to ammound. NH_3^+ group releases the proton and changes to amino NH_2^- group. Therefore, the acidic character is due to NH_3^+ group.

Essential Amino soids

- valing
- Leucine
- Iso leucine
- Arginine
- Lyeute
- Threomate
- Methodane
- Phenyarienane
- Terestophau
- Hasadore

These easent a minute ands are required for the growth of our body and their deficiency ratises thenses such as Knockhorkor to this distanted. As a result, some argues of the body become watery and bloated.

REMEMBER

<u>Го о-инсоло велба</u>

- scide character is due to NH₃*
 group
- basic character is due to -COO group

Thus, in animo weeds, the basic character is due to the "COO" group whereas the acidic character is due to the "NH_g* group.

Table 2 Structures and names of some e-amino acids having general structure:

		(R)		
	cramino aerd	R Group	Three letter Abbreviation	One letter Abbreviation
		Neutras Amme Acade		No.
1	Glychae	Н	Gly	G
2,	Alsone	-CIH ₃	Ala	A
28.	Vallos*	-CH(CH ₁) ₁	Vei - ,	v
4	Leucine*	-CH ₂ —CH(CH ₃ / ₂	Leu	L
δ	autelionae*	«CHCTH _J)—CH ₄ —CH ₄	Пе	1
ò	Phenylalanme*	·CH _c ·Ph	Phe	P
7	Metaionaie*	°H, 'H, S—CH ₃	Met	М
8	Tryptophan*	CHY (N)	Тер	V ₂
		н		
ē.	Protine	H H	Fre	P
		н		
		(Crorglete steueture)		
10	Sampa	-CH2 -CH /	Ser	8
11	Cystage	CIH ^{II} —SH '	Суп	M
12	Aeprogine	CH. CONFE	Aen	TN .
18.	G) чельне	"Har a" . " " Wha	(i) (r	Ģ
.4	Threomae*	CHOH AH,	The	Т
12	Тутовше	Amdir Anima Amda	T'yr	¥
∡e.	Aspertir and	H _c of a H	Аер	Г
, 7	ि भूतमण्ड गलवे	H ₂ TH ₂ A010H Boar Amine Acuts	(Fig	E
ıB.	Lysine ⁴	-CH ₂ -(CH ₂) ₂ -NH ₂	Lya	ĸ
18	Arginine"	ਾਸ _ਕ ਵਾਸ _{ਕ ਕ} ਾਸ਼–ਾ– ਜਿਸ _ਕ 1	Arg	ĸ
		NH NH		
20.	Historians*	-CH, NH	His	Н

Calmered are exceptiat amino mide. Ph stands for piscoyl.

lecelectric point = pH nt which there is no net charge ...o., somno sed does not ougrate under electric field

Numbydein test. All ammo neda on treatment with numbydein 2 2-debydeoxymdana-1.3-dione give purple calcuration. This test in called nimbydein test and it used for the detection of amino acids.

REMEMBER NH— bond is called peptide bond or peptide linkage.

ISOELECTRIC POINT OF AMINO ACIDS

Ammo acids have zwitter on structure. NH3CHRCOO and we expect that their aqueous solutions would be neutre. However, aqueous solutions of neutral amino acids are sughtly acidic because the acidic character of NH3 group is more than the basic character of COO groups. When we place the aqueous solution of an outant acid it at electric field, its behaviour will depend upon the acidity or basicity of the solution. In alkaline solution, an amino acid exists as a negative ion. If and imprates towards anone under the influence of electric field. On the other hand in acidic solution, texts as a post tive ion. If and imprates towards cathode under the influence of electric field.

R CH COO
$$\xrightarrow{H^+}$$
 R CH COO $\xrightarrow{H^+}$ R CHCOOH

NH₃

NH₃

NH₃

III

However, at a certain hydrogen noncontration (pH), the dipolar ion exists as a network for and does not imposte a enther electrode. In this solution, the structures II and III are exactly balanced and therefore, there is no net migration of amino and

The pH or hydrogen ions concentration of the solution at which a particular amino and does not migrate under the influence of an electric field is called isoelectric point of that sauno and

The isoelectric point depends on other functional groups in the amino acid. The neutral amino acids have the soelectric points in the range of pH 5.5 to 6.3 ing. gluone pH = 6. For acidic amino acids isoelectric point ies between $pH \oplus 1$ 2.5 e.g. a rather ico pH = 9.0 white for basic amino words it was between pH = 10.8 (e.g., lysine, pH = 9.7)

At unelectric point, the among occurs have the least solubility in water and this property is user for in separation of different amino and solubilities from the hydrolysis of protests.

Amino acids form saids with acids and bases. Their chemical properties are similar to primary amines and carboxylic acids.

PECTIONS AND PROTEINS

Peptides are compounds formed by the condensation of two or more same or different than to grade. The condensation occurs between on me ands with the entire atom of water. In this case, the corboxyl grade of the animo and and omino group of another animo and gets condensed with the elimination of water more tile. The resulting an CO—NH—mixage a chiled a peptide linkage or peptide bond.

The formstion of a dipoptide and the peptide linkage is shown below

Atternstively the amino group of glynne may react with carboxyl group of alanine resulting in the formation of a different dipeptide analylg vine. Ala-Giy. In both these apeptides the glycyn lanine or analylglycine there are free functional groups at both ends. These groups can further react with the appropriate groups of other amino acids forming tri, tetral pentapeptides and so on.

Polypeptides

If a large it uniber of common sends (it indreds to that sands are joined by peptide bonds, the resulting polyamide is called polypeptide as snown below

It is clear from the above at return that each polypeptide chain has a free non-to-group. NH, at one end and the free carbony group. COOHs at the other end. The ammo group end is called ammo or N-terminal end while the end aiving free. COOH group is called C-terminal end. The silutions is generally written with N-terminal end to the left and C-terminal end to the right. The name of the peptide is written from the names of the ammo acide as they appear from left to right starting from N-terminal ammo acid. The suffix-ine in the name of the amino acide replaced by when a glycine to glycyl, alanine to alanyl, etc. for all amino acide except C-terminal and, thereafty polypeptides are written with three letter abbreviation or one letter abbreviation for amino acide. For example the tripeptide formed by glycine, alanine and serine is written as

Similarly a imperiode alanyig yeyl-phenylalanine is represented as Alanine Giyeine Phenylalarine

Depending upon the familier of time a saids residues per materiale the peptides are called a peptide impeptide polyophide etc. The formation of peptide bonds can continue until a molecule containing several hundred thousands amino acids is formed. Relatively shorter peptides are called **oligopeptides**, while larger polymers are called **polypeptides** or **proteins**. By convention, a peptide having materials mass upto 10 000 m s called **polypeptide**, while a peptide having a motecular mass more than 10,000 a s called a **protein**. However, the distinction between a poly with a larger in a not very sharp. A polypeptide with a fewer chamber under may, let be called a protein of those a well defined conformation of a protein, such as the interior which contains 51 amino acids.

Polypeptides are any proteine because of the presence of terminal aminomian and carboxylate ions as we'll as the ionized side chains of animo and residues. Therefore, they behave as acids in bases and have an isoelectric point at which they are frequently least southle and have the greatest tendency is aggregate.

Most of the toxals posson as a distances in animal venous and all plans sources are polypeptides. A remeative of dipeptide aspartly) phenylalarine methylester aspartame is about 100 times as sweet as sucrose and is used as sugar substitute as sweeting agent.

REMEMBER

luculiu protein containa 61 annuo acida

SOLVED EXAMPLES

□ Example t...

Write the formula of a tripeptide alanyiglycyl phenylalanine Solution (The formula of tripeptide is

Example 2-

A tripeplate on complete hydrolysis govers, where alone acondipmenylamin ac. Loing three tetter symbols were to down the possible sequences of the tripeptide. Solution. The possible combinations are

(f Cly-Ala-Pha

#D Ala-Gly-Phe

tra Phe-Gly-Ale

to Gly-Phe-Ala

(v) Ala-Phe-Gly /

(ed) Phe-Ala-Gly

PROTEINS

Proteins are complex introgenous indicates which are essential for the growth and maintenance of the These perform a wide variety of biological for thous. Proteins are the constituents of cells and, therefore, are present at his inglication. The indicates masses of proteins are very high. Structurally, and one are long passings of time and at the day pertident. CO. No bonds.

H

CLASSIFICATION OF PROTEINS

A. Classification of proteins on the basis of me ecular structure

Proteins can be classified into two broad classes on the basis of molecular structure as

L. Fibrous proteins (a) Globutar proteins

- if Fibrous protests. These types of proteins consist of mean thread the approximes which tend to be side by side to form fibres. The not lecules are held together at many points by hydrogen bonds or disulphide bonds. These are usually assorbe to water. The common examples of fibrous proteins are kenthrick askin, hair, nails and wood, collager in tendons, fibroin in silk, myosin in muscle, etc. These proteins serve as the main structural materials of animal basices.
- n Globular proteins. In his type of proteins, the moterness are faided together into compact mosts forming, spheroidal shopes. The peptide chains in globular proteins are also held by hydrogen bonds but these forces are comparatively weak. These are soluble in water in aqueous solutions of ands, bases or salts. The common examples of globular proteins are in human, manner, etc.

The globular proteins have many important biological functions. For example,

. Some biological proteins function as enzymes to catalyse biological reactions.

Some proteins regulate metabone reactions. For example, the protein humane insulin from pancreas) maintains blood sugar level.

u Some proteins act as antibodies which protect the body from allergies and provide defence against foreign organisms.

Differences between globular and fibrous proteins

	Giocular protecns	Fibrous proteins		
1.	These proteins are cross linked condensation products of basic and acidir amino acids	These are linear condensation products		
2	These are soluble in water or aquenus solutions of scide, bases or salts.	These are meanable in common solvents but soluble in strong code and bases		
5	The globular protein molecules are folded to give three dimensions, substraints above. There are stable sed by mission bydrogen builds.	The long onear protess chains are bed agether by intermoted on hydrogen bonds.		
4	Examples of globular protons are administrate egg, all arraymes and harmones	Example are myosis in nuiscles, herator in hair fibrour in silk, collagen in tendons		

Bill lassification of projects on the basis of hydrolysis products

Based on the type of products formed on hydrolysts, the proteins may be classified as

u Simple proteins 11) Conjugated proteins (ii), Derived proteins.

Simple proteins. These are proteins which give amino acids only on hydrolysis with acids or enzymes. The important examples are - \u03c4 \u0

as Conjugated proteins. These are proteins which an hydroly as give a time-protein part and as one no acids. Thus, these are formed by the employed at all of simple proteins with some not protein ous substance. The controls of the protein is called **prosthetic group** and a controls the biological functions of the protein. The common prosthetic groups in the proteins are

Name of proteins	Proethetic group
Nucleo proteus	Nucleic scide
Alyro protettia	Sugare carbohydrares
Lipo proteins	Ligade such as less him
Phoephu proteins	Phosphoric seid residues
Chromo proteins	Pigment having some metals
Haemoglobin and myoglobin)	such as Fe. Cu (Haemoglobin)

The most important are the phosphorus con aming nucleo proteins. They are compounds of simple proteins and anylest and and are found in cell nuclei.

• Derived Proteins. They are the products of partial hydrolysis of simple or conjugated proteins. For exam, in proteines, peptones, polypeptides, etc.

Proteins +Proteines +Peptones +Polypeptides

STRUCTURE OF PROTEINS

Proteins are more youers containing a lorge number of amino acide joined together through paytide bonus having three dimensional 3 D latructures.

The structure of prote is as very complex. The protein structure and all ope can be usually studied at four different levels in primary secondary terbary and quaternary structures. These are discussed as follows.

1. Primary structure

Proteins may have one or more polypeptide chains. Each polypeptide in a protein has amino acids anked with each other in a specific sequence. This sequence of amino acids is said to be the the omitary structure of this protein. Thus, the sequence in which the amino acids are linked in one or more polypeptide chains of a protein is called the primary structure of protein as shown below.

The primary structure is usually determined by its successive it virolysis with enzymes or indeed across to its. The amnormal sequence of a protein determines its function and is critical to its biological school Frederick Songar determined the primary structure of a protein use in the fact that even a change of one amnormal condition change drastics by the properties of the entire protein. It also creates a different protein. For example, a normal basingoing the sequence results in defective basings obtained in patients suffering from sickie celebration.

Normal haemoglobin

Vel—He—Lew Thr—Pro— in the Lys— Sickle cell haemoglobin

Vel His-Leu Thr. Fro Va. Glu Lys-

In the patients suffering from aickle cell such... The defective baconglobin in two wood cells precipitates causing the cells objectle and sometimes even surativating ultimately to the death.

A protein containing a total of 101 amins acids residues is a very small protein, yet 20 different amino acids can be combined at one time in -20 his different ways.

2. Secondary structure

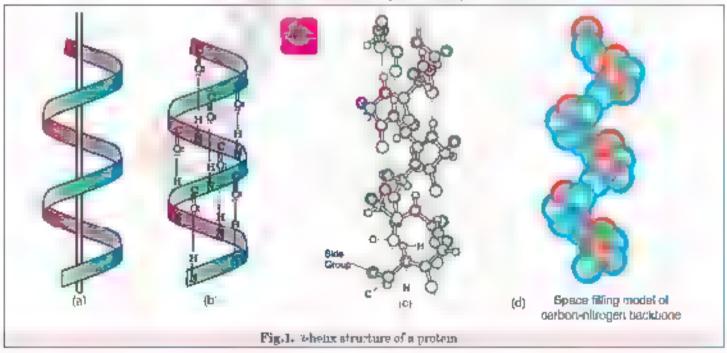
The secondary structure gives the manner in which the polypeptide chains are finded or arranged. Therefore, it gives the shape or conformation of the protein molecule.

This arises from the plane geometry of the peptide bond and bydrogen bond between the > C = 0 and > 0. High groups of different peptide bonds.

Putting and Corev mass, gated the structures of many proteins with the help of X-rays patterns. It was observed that there are two common types of structures.

o a-Helix stranture

It a the most some in form in which a polypept dechoir forms all possible types of hydrogen bonds by twisting into a right handed screw belix with the NH group of each amino and residue hydrogen bonded to the >0 = 0 group of an adjacent than if the hear as shown in Fig. 1.6. This is residue 0-belix. This structure can be imagined as if one can cuit a polypeptide chain around an avisible cylinder. The 0-beha model was proposed by and a Parling in 2051 on the rasks of theoretical considerations. However, these later verified experimentally. To independ this, let us consider the



geometry of peptide bond. A peptide bond is shown below up this structure. The peptide groups are trans to each other

The carbon-in roger bond in the aim to hakage is usually snort which indicates the resonance between the two structures

Due to the portion double bond of protect of the C. N bond is pertile. unkage the amide part e. AH CO- is planar and rigid Therefore, rotation of groups about this bond is not possible. As a result of andered rotation size peptide bons can show geometrical sometiems in electronic consistents. Further because of much larger stems repulsions between the alky groups, the national a for stable. The cross form a more stable and therefore, the pept, by get pa are frans to each other

However retation of a peptide chain car occur only and ad the bonds." joining the near's planar anade groups to the carbony carbon to orbon.

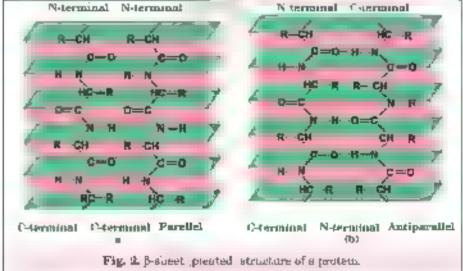
These rotations allow peptide chains to form different confirms with The angles through which rotations are possible are also so led flat tachandran angles after the name of the Liban B. physics: G.N.A. Ramachandran: They were defined in terms of angle ϕ for α -carbon to imide introgen bond ωc , between $R_1 \subset H$. $\forall H_1$ and angle Ψ for the C-carbon to a carbony bond we between R CH CK Na

The stability of the structure is due to the hydrogen combing between - NH and - $\zeta=0$ groups of peptide bonds. Therefore, a structure having maximum hydrogen bonding shall be stable and favoured. The ω -heux structure is also known as 8.6, a helix. This represents that each time of the hear contains approximately 9.6 amino acrost and a 13member ring 2 formed by hydrogen bonding. The nebx is neithin its shape primarily by hydrogen bonds between one aroide group e si corbonyl group which is 9.6 er incidental ands away.

L may be noted that in proteins, the beha has a ways a right handed arrangement. If you keep your hand so that the r mb points in the direction of trave. This the axis of he selfs her he curl of your fingers gives the breetion. in which the behix rotates. All amino acids, it is polyperpude chain have L-configuration and therefore, it can form a stable α -beax only $d \sim a$ right banded. α -behx structure is found in many proteins such as myosin found in muscles, and were notfound in hair, wool and naua).

β-pleated sheet structure

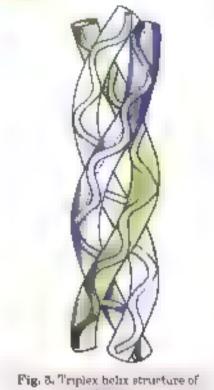
The was also proposed by Line & Pauling and co-workers in 1951. In this structure, a highly peptide chains are stretched out to nearly maximum extension and nen said side by side in a zig-zag manner to form a flat sheet. Each chain is held to



the two neighbouring chains by hydrogen. bonds. These sheets are stacked one upon another to form a three dimensiona. structure called β-pleated sheet structure Fig 2. The structure resembles the pleated folds of drapery and, therefore, is

known as B-pleated sheet

Two types of pleated sheets are possible. The polypeptide chains may run parallel i.e. the adjacent chains run in the earne direction or may be entireded in a the adjacent chains rim in the opposite direction as shown in Fig. 2. In other words. in parallel β-conformation N-terminals are augned head to head we,, on the same aide. On the other hand, in antiparalle. conformation (Fig.2 (b)) the polypeptide chains are aligned bead to tail which means that N-terminus of one chain and



colargea

C-terminus of another chain are on the same side. For example, kerotin protein in nor the parallel β -altert structure and s_{ijk} protein β brown the autoparallel β -abect structure.

It may be noted that a protein may or may not have the same secondary structure throughout as length. Some parts of the chain may have when a structure while other parts may have β-pleased sheet structure. Some parts of the chase may ever have no secondary structure at all. Such a structureless part is called a randem coll.

3. Tertiary structure

The text ary structure arcses due to folding, conting and bending of polypeptide chains producing three-dimensional structures. This structure gives the overall shape of proteins. In other words, the tertiary structure of a protein. gives the overain folding of polypeptide chains .e., furtilier folding of the secondary structure. Two major moter dar shapes for ad are fibrous and groundar. These are already discussed

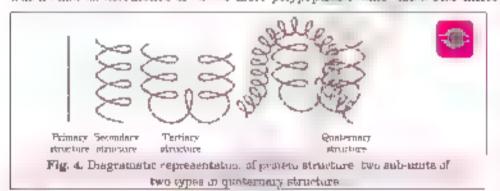
The fibrous proteins such as saker lagen in a a-keratura have large liebra. concent and have rod-uke rigid shape and are insoluble in water. The structure of collager triple helix is shown in Fig. 9.

In the other hand, in globular proteins such as haemoglobin the polypeptide change consist partly of hearest sect this will are folded about the random cuts to give at a aphenical chape. Perutz and Kendrew determined the certary structure. of bacmoglobin and myoglobia prough X-rays determination and were awarded Noble Prize in 1962.

The main forces which is abuse the secondary and certiary structures of protests are hydrogen bonds. sulplinde ankages, van her Waan and electrostant. forces of autraction.

4. A national as Stated in-

Many proteins exist as a single polypeptide chain but there are some proteins. which exist as assemblies of will it more polypepta is a mas lailed sub-units in protomers. These sub-units may



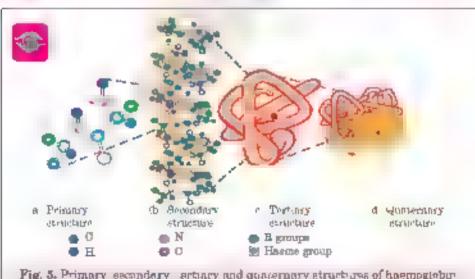


Fig. 5. Primary secondary servary and quaternary structures of hasmoglobur

be identical or different. These are held together by non-covalent forces such as hydrogen bonds, electrostatic interactions and van der Waals interactions. The quaternary structure refers to the determination of the number of sub-units and their arrangement in an aggregate protein motecuse. The best known example of a protein possessing quoternary structure is haemoglobin which transports oxygen from the ungs to the cells are arbon dioxide from the cells to the langs through the blood stream. It is an aggregate of four polypeptide chains or sub-units, two identical gipha chapits leach containing .41 mino acid residues. and two identical belo choins each containing 140 aromo acid resi wes -These four sub-units he more or less at the vertices of a regular. letrabedron Each polypept de chara curries a heme group, ironprotoporphyrin complex at its end-

The four types of structures of proteins are shown in Fig. 4. In this structure each ball represents an ammo sed.

The primary, secondary, tertiary and quaternary structures of haemoglobin are shown in Fig. 5.

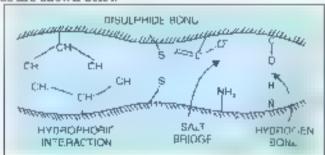


FORCES THAT STABILIZE PROTEIN STRUCTURES

The following types of forces stabilize the protein structure

- I hydrogen ben ting. These are weak forces and arise between a partially positive hydrogen and a partially negative atom such as oxygen, fluorine or introgen on the same or different molecule.
- 2 but a none and I have bonding car, take place between an ionic and cationic side charm resulting side chain cross miking
- 3. Covered now long. The most common form of inter-chain bonding is the distribute bond formed between the surphus atoms of two systems residues. The mention consists of two polypeptide chains unked together by covalent bonding.
- a saleophotic bonding Many amino and residues have hydrophotic water hating sale chains. Proteins in aqueous solutions fold so that most of the sydrophotic chains become constered maide the folds. The polar side chains which are hydrophic to water iowing he on the outside or the surface of the protein.

These forces are shown below



NATIVE STATE AND DENATURATION OF PROTEINS

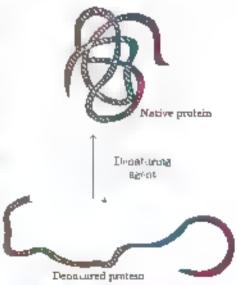
Native state. The most energetically stable state of a protein is called use native state. In other words, aution state corresponds with proteins found in a biological system with a unique three dimensional structure for configuration and biological activity.

Denaturation of proteins, A process hat changes he physical and biological properties of proteins withou, affecting the chemical composition of a protein is called denaturation. The denaturation is caused by certain physical change like change in temperature or a chemical change like change in pH. presence of salts or certain chemical igents. Due to this globules unfold and helix get ancorled. As a result. The protect molecule uncous from an ordered and specific conformation into a more religion; conformation and protein precipitates from solution. Changes in pH have the greatest disruptive effect on hydrogen. bonding and sale bridges in proteins. For example, the polypeptide polylysine is composed of aming and lysme morecules which have aming one group an the side of the chain. In acidic medium, all side chains get protonated and recome positively charged. As a result of similar charge, they repell each other and causing the molecule to uncoil. Heating increases the thermal vibration. of the under det descripting hydrogen contains and sad bridges. The denatured proteins will use its biological activity. It may be noted that during denote rotion he secondary and tertiary structures are destroyed but the primary excuence remains uttact

Protein denaturation may or may not be reversible.

Examples of Denaturation of Proteins

1 The most common example of denaturation of protein is the congulation of abunum present in the white of an egg. Proteins present in egg white are



Denatured protoin certary structure is broken.

REMEMBER

Denaturation does not change the primary structure of proteins.

globular and soll ble. When an egg a noded a water the globular protests present in it change to a rubber like insoluble mass. This is irreversible denaturation and the protein cannot return to its original state.

- 2 Curdling of milk is another example of densituration of proteins. It is caused due to the formation of factor and by the bacteria present to milk
- 8 The coagulation of milk to the presence of an acid teman juice to form choese is also an example of denaturation of proteins. Furing this penaturation the globular milk protein actuallymen becomes fibrous.

It may be noted that in some cases, he detail ration process a reversible. It is found that if the disruptive agent is removed. The protein recovers its original physical and chemical properties and in lagren activity. The reserve process of denotination is called **renaturation**.

ENZY MES

The enzymes are biological catalysts produced by hoing cells which cutained the broch in the machines in the organisms. Chemicany enzymes are naturally occurring simple or confugate proteins. Some enzymes may be improfess also almost a let zy the are globular proteins. Without enzymes, the owing processes would be very glow to sustain life. For example, without the presence of enzymes in our agentive tract, it would take about 50 years to digest a single meal. All enzymes are processes. About 3000 enzymes have been identified. The enzymes differ from other types of catalysts in being highly selective and specific.

The enzymes are generally named after the compound or class of compound upon which they work. For example, the enzyme which calle years, a hydrolysis of maltose into glurose is named as maltase.

$$C_{12}H_{22}O_{23} + H_2O \xrightarrow{\text{Mahase}} 2C_6H_{12}O_6$$

Mahase

Glucose

Sometimes the enzymes are also named after the react on where they are used. For example, the enzymes which causlyse the oudstion of one substrate with a notific reduction of another substrate are named as oude reductase enzymes. The ending of the name of an enzyme is lase.

The enzymes facilitates the biochemical reactions by providing alternative lower intivation energy path and, therefore, increases the rate of reactions. At present about 3000 enzymes have been recognized by the Interna. Union of Biochemistry However only about 10%—e. 300 are commercially available. Some common enzymes and the reactions which are catalysed by them are given in Table 3.

Table 3: Some common examples of enzymes.

Enzyme	Reaction ea	Reaction catalysed				
Maitese	Martose	 Gracose + Glacose 				
Landage	Lactnaa	 Gaucosa + Garactise 				
Amylasa	Starch	4 vi ti Glucose				
Invertase	Sucrose	♦ Ghuose + Fructuse				
Unesse	Ucea	→ UU ₅ + NH ₅				
Carbonic anhydrace	$H_a CO_a$	4 (CO) 4 H ₄ C				
Рервам	Proteous	 Autuo acide 				
Теурана	Proteina	 Amuso serde 				
Nucleases	EONA RINA	Nucleotides				
RNA Polymorae	Rabonacteotak	s triphosphates - + RNA				
DNA Polymerase	Decaymenteets	de riphosphme - FNA				



Proporties of Enzymes

The important characteristics of enzymes are

- 1 If ghe flower on Enzymes increase the speed of reactions to to 10 m nontimes as compared to the uncatalysed reactions. This is because the enzyme reduces the traginguide of activation energy. For example, the activation energy of said hydrolysis of sucrose is 6.22 kJ mol⁻¹ while the activation energy is only 2.15 kJ tool⁻¹ when hydrolysis is corried out by the enzyme sucrose.
- 2. Extremely small quantities of enzymes as small as nathouth of a more—can increase the rate of reaction by factors of 10^4 to 10^4
- 3. Specificate The er zymes are highly specific in nature. Almost every mochemical reaction is controlled by his own specific enzymes. For example, matter catalyses the hydrolysis of manose. No other enzyme can catalyse its hydrolysis.
- Opt main comport turn and pU. The enzymes are artise at moderate compensate (about 37°C) and pH, around 7).
- 5 Contraction to twif revines The action of enzymes are controlled by various mechanisms and are inhibited by various organic and morganic molecules.
- The netivity of most enzymes is closely regulated.

Coenzymes

In some cases, most active enzymes are associated with some non-protest components required for their activity. These are called proethetic groups. The prosthetic group which is covolertly attached with the enzyme motecule is known as cofactor. The prosthetic groups which get attached to the enzyme at the time of reaction are known as coonzymes. These are generally metal ions or small organic molecules. The common metal ions are Zn. Mg. Mill, Fe. Ct. Co. Mo. K and No. Several coenzymes are not veo from vitamins such as theamins, maxim, mboffavin, etc. In some cases, the enzyme activity can be reduced or mainted by the presence of certain compounds known as enzyme inhibitors.

Mechanism: Enzyme Catalysed Reautions

Browlean are trying to explain the exact molecular basis of enzyme catalysis. The various steps involved to the enzyme catalysis reaction are given below.

(a) Binding of the enzyme | E) to substrate | S) to form a complex.

ES is called the enzyme-substrate complex.

(a) Product formation in the complex

where EP is a complex of enzyme and product

su Release of product from the enzyme-product complex

These steps are shown in Fig. 6

The catalytic property of enzymes is present at certain specific regions on their surfaces. These are called active

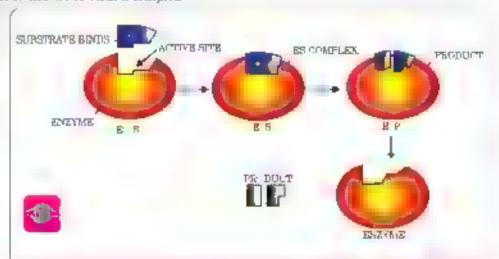


Fig. 8. Enzyme-substrate binding

REMEMBER

Deficiency of enzyme

- phenyl alanine hydroxylase causes disease phenyl ketone uros
- tyroamass causes disease nibinism

sites or cate your sites. The active sites have characteristic at one and if it at stably shaped specific substrate molecules. Specific binding accounts for the high specificity of these or syme reactions. The specificity of fitting ingether of the substrate structure and the enzyme structure may be compared as a **key fitting** into a lock. The shape of the active site of any given enzyme is such that only a specific substrate can fit into it on the same way as one key can open a particular lock.

Applications of Enzymes

- I known of foreness or prevent another see The Jeffereneses of enzyme in hying system cause many diseases. Some I these are given below
- (a) The deficiency of phenylalanine hydroxylase enzyme causes a congenital disease called phonyl-ketone urda. This disease causes archimilation of compounds in the body which results into severe brain damage and retardation in children. This can be prevented by a diel with low phenylalanine content.
- Definency of enzyme tyrosmass, as use, albimsm. Due to definency of tyrosmase sufficient melanic a pigment which gives colour to the skin or hair is not produced. Therefore, the persons and animals suffering from this disease have white skin or hair.

These diseases can be prevenue: by the supply of enzymes through diet.

- 2. t among discusses. Certain enzymes are also assets for treating heart discusse. An enzyme streptokinase is used to dissolve blood clot to prevent heart attacks.
- 3 Incusor a spplicat ins. The enzymea are widely used in industrial processes. For example, anxymea are used
 - or brevenes for the monufacture of been wone etc. by the fermentation of carbonymetes.
 - a, in food processing industries for preparing aweet, syrup, etc.
 - (iii) in the production of cheese by congulation of milk.

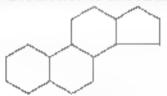
HURMONES

Hormones a still chemical substances which are produced a disclusive groups in the rooty. These are carried a different parts of the rooty by the blood stream and ontrol various body functions. Because of the action of hormones as communication among cells, they are called **chemical messengers**. The deficiency of hormones causes metabolic disturbances of a body to naminals, the secretion of hormones is controlled by the acceptance of the party form grand present at the base of the brain. These normones are transported at other glands such as advance rootex, thyroid and sex glands to stimulate the production of other hormones.

Classification of Hormones

Based upon the structure of hormones, these are classified into three main types

Steroid hormones. These hormones, contain a steroid nucleus which is used on a four-ring network consisting of three cyclohexane rings and one cyclopectane ring. These are mostly secreted by testes and adrenal cortex of males and are called sex hormones or adrenal cortex hormones.



Steroid nucleus

The common examples are lestoslerone diliydrotestosterone and androgens. During puberty, these samulate the male sex characteristics. In females, examples are fewere sex normones which are produced a ovaries and are responsible for development of female sex characteristics during puberty.



Protein or polypeptide hormones. These normones contain a peptide chain. The common examples are oxytomn, casopressin and insulin

a Amine hormones. These are water so able conpounds which he've mann' group and are structurally derived from am no creats. The count in examples are adventise and thyroxine

Examples of Hormones

Some common hormones and their functions are given below

Table 4: Some typical hormones.

Table st conte typical normotes						
H	[oru	0000	Organ of si	erretion Functions		
STEROID HORMONES						
(44)	(a) Sex Hormones					
	1.	Testosterone	Testes	Regulates the Tevelopment and normal functioning of male sex organs.		
	8.	Estrogens Estrone or Estradiot <i>)</i>	Overy	Control the development and normal functioning of female sax organs.		
	3.	Progesterone	Corpus zateum	Controls the development and montenance of pregnancy.		
$\langle 1 \rangle_{\rm c}$	Ad	renal cortex ho	rmones			
	4.	Cortinone	Adrenal cortex	Reg nate the metabolism of fata proteins and carbollydrates; control the balance of water and minerals in the body		
l l			РЕРТШЕ Н	ORMONES		
	5. Oxytocin 6. Vasopressin 7. Insulin		Posterior pituitary gland	Controls the contraction of the ateros after child birth and releases milk from the mammary glands.		
			Pitutary glands Paperess	Controls the resbearption of water in the kidney, Controls the metabolism of glucose, munitains glucose level in the blood.		
			AMINE HO	RMONES		
6.		Adrenatine or Epinephrine	Adrenal memma	Increases pulse rate and controls from liver glycogen and futty acids from fats in emergency		
	θ.	Thyroxine gland	Thyroid gland	Controls metabolism of carbohydrates upda and proteins.		

VITAMINS

These are organic con. por ads which cannot be produced by the body and mast be supplied a small or masts it due to perform specific brongers functions for the normal health growth and mandenance of body. These are essential to as for the proper functioning of the different organs. They are chemically different from the main nutrients, fats, carbohydrates and proteins. The absence or deficiency of a situating can cause specific diseases. Multiple deficiencies caused by ack of more than one vituating are more common in human beings. This condition of vitamin deficiency is known as a vitaminoses.

The actual formulae of a tankins are very computated. For the sake of simplicity, these are designated by a phabets, A. B. C. D. E and K. Any subgroup of individual viraning is designated by the number subscript e.g. A_1 A_2 , B_1 B_2 , B_3 , B_{12} , D_2 , ect. as water soluble or fat soluble.

REMEMBER

- The condition of vitamin deficiency
 a evitamanages
- The condition of excess intake of vitamins is ⇒ hypervitaminoses



Originally, the term vitemine was comed from the word vital + amme because the earliest identified compounds had ammo groups. Later studies showed that most of them did not centrum ammo groups, so the letter was dropped and the term vitamin is used these days.

Classification of vitamos

Vitamine are generally classified into two broad types based on their solubility

Water soluble vitamina

The vitamins which are soluble in water are called water soluble vitamins. For example, vitamins B group B-complex vitamin C etc. The water soluble vitamin is are stored in milet lesser ombunits in the cells. Water soluble vitamins in solve supplied regularly in that because they are readily excreted in tiring and cannot be stored (except vitamin B_{19}) in our body

Fat soluble vitamina

The natural as which are somble in fals are called fat soluble vitamins. For example vitamins. A, D E and K Liver teams are not in fals outble vitamins such as vitamin A and vitamin D. This group of hydrophodic, apid somble vitamins are not absorbed in the body unless fat digestion and absorption proceed normally. Their deficiency can cause malabsorptive disease. Excess intake of these vitamins may cause hypervitaminoses.

It may be noted that vitamin H. Biotar in neither soluble it, water nor at fata. Sources of Vitamins

Plants can synthesize almost all quantum whereas only a few vitamins are synthesized in animals. Vitamin D may be supplied through food or may be produced in the akin by uradisation of alerols with stinight fultraviolet ughts. Human body can synthesize vitamin A from carotene and some members of vitamin. B-complex and vitamin. K are synthesized by micro-organisms present in intestinal tract.

V tamms are widely instributed in nature both in plants and animals. All relia is the body can a fore virtualist to some extent. Most of the vitamina have been synthesized and are averable commercially. These are generally to ken orally Functions of Vitamina.

The common vocations their sources and important functions are given below

1 Vitamin A Retinal

The chemical name of vitamin A is retinol. It is a far soluble $vita\sim u$. It is also called **bright eye vitamin**.

Functions. (3) It helps in proper growth and normal akeletal development of the body

- if) It plays an important role in mointaining proper vision.
- iz It is also essential for healthy teeth structure
- (a.) It helps in the maintenance of healthy, glowing soft skin.

Sources. Butler liver carrots spinach, ghee kidney yellow pumpkin, mustard leaves, whole milk fish oil particularly shark liver oil, liver of fresh water fish, tomatoes, comander leaves, curd, mangues, egg yolk, cheese, papaya.

Vitamin A is present in the form of carotene in vegetables and fruits which are converted to vitamin A in the body. In general, the darker the colour of the green vegetables, greater is their carotene content.

Deficiency of vitamin A causes mgh, bundness and perophthic arrange bardening of cornes of eye

Vitamin B - Group

Vitamin B is a water soluble vitamin. It consists of eleven substances. Out of these vitamins, B_1, B_2, B_4 and B_{12} are important

2. Vitamin B. (Thermine)

The chemical name of vitamin B, is thiamine. It is a water soluble identiti-

Functions 40 Vitanua B, helps in carbohydrate metabolism

- u) It heips in functioning of heart, nerves and muscles.
- iii) It sharpens our appetite and is sometimes referred to as an "appetite vitamin"



Sources, Malk prises, wheat from sea food yeast, whose grain cereals, green vegetables, soyabean, dairy products (except butter).

The deficiency of vitamin B, causes beri-beri-

3. Vitamin B. (Riboflavin)

The chemical name of vitamin B_n is riboflavin. It is a water swable when in

Functions. (i) It helps in oxidation and utilisation of mygen.

- at It helps in carbohydrate and protein metabolism.
- (ii). It is necessary to keep the skin healthy
- (iv It help in the normal functioning of the eye.

Sources. Meat, whole grains and pulses, milk, yeast, over peas, eggs, green vegetables.

The richest sources of riboflavin is dried yeast and liver

The deficiency of vitamin B causes cracking of skin, aps, corners of the mouth, plantes, obia enuglicaye idaz dark red tongue glossitis

4. Vitamin Ba (Ninein)

Vitamin B_3 is also called **miscin**. It is a water somble vitamin belonging to the B-complex group. It is one of the most stable of vitamins.

Punctions. It is needed for the metabolism of carbolly drates, buts and proteins

- in It keeps the skin healthy.
- tar It gives sound mental health.
- (ii) It has most important positive contribution to good nutrition.

Sources. Malk fish legumes potatoes green leafy vegetables meat, eggs, fowl (chicken), whose grain.

The deficiency of vitamin B, couses pellagra-

5. Vitamin B. (Pyridoxine)

It is called **pyridowne**. It is a water soluble vitamin. Infact, it is a mixture of three substances, pyridowne, pyridoxal and pyridoxalmine.

Sources. Cerears grams, monasses yeast, meat, for legg york rice bran-

The deficiency of vitam in B_n causes severe—eric withs, convolutions ansemia, etc.

6. Vitamin B., (Cyanocobulamin)

The chemical name of vitamin $B_{\tau \theta}$ is symmocobalamin, R is also a water soluble interior.

- Punctions. (: It is essential for the metabolism of cervous tissue
 - ii. It is necessary for the formation of healthy blood and proper growth of the body
 - (as) It is essential for preventing the disease called permittous ansemis

Sources. Liver, cheese, milk, eggs, kidney, fish, mest

The deficiency of volume B_{χ} causes permissions under a inflammata is of tangue and mouth.

7 Vitamin H (Biotin

It is also called blothe

It is neather soluble in water nor in fat

Sources. Yeast, liver, kidney and milk.

The deficiency of vitamin H causes dermatitis, depression, loss of hair and paralysis.

8. Vitamin C (Ascorbio acid

The chemical name of vitamin Γ is necessic need. If a_{in} intime is t is the most highly soluble in water

Functions. It is necessary for keeping teeth, game and joints healthy.

It plays an important role in normal metabolism of the amino acids.



air. It helps in healing of cots and wounds.

(10) It gives resistance to our body against diseases and infections.

Sources. Amia. tomatoes, mongoes, oranges, pears, pineapple, cabbage, apples, lemon, lime green chillies, gusva.

Amia is a good sources of vitamin O.

The deficiency of vitamin C causes scurry

9. Vitamin D Ergocalciforol,

It is also called calciferol.

If is a fat soluble ortain. It is formed in the ekin under the action of sunshine

Punctions. (b) It keeps the bones and teeth healthy

(ii) It heips in the utilisation of cideium and phosphorus.

Sources. Cod aver oil, butter, milk, agg yolk, fish, ghee, cheese.

Exposure to surgify provides or the $_{\rm P}$ method of production of vitamin D in the body itself

The deficiency of vitamin D causes mckets.

10. Vitamin E (Tocopherol)

The chemical name of vitamin. Fits tocopherol. It is a far soluble internate

Functions. It plays an inportant role in the protection of vitamin A, caretene and exceptive acid.

iz It is necessary for the normal reproduction and protection of the liver

Sources. Vegetable of a mark towatoes dark green leafy vegetables legge. bidney, whole grain cereals, nuts, liver

The deficiency of ottamin E causes loss of sexual power of reproduction

11. Vitemin K (Phyllogumone)

It is also known as phylloquinone.

if is a fat soruble vitamin. It is size called coagulation vitamin.

Functions. It is ps in clotting of blood and prevents agemorrhage

Some reservations their sources and the diseases caused by deficiency of these are bated below

Vitamin	Chemica, Name	Deflotency Disease	Sources of Vitamon
A	Reunol bright eye vuzimin	Secophthe man a newtening of mimen of eye ar might blundness	Cod liver on shark over mi, carrot, rue pobshing, liver indicey, butter milk etc
By	'Гъзаписов	Remaining one of appetitive, retained growth diseases of persons system	Milk rice veest in its, aggs, green vegetables, over kidney
B .,	Riboflavas	Closses dark red tongue dermatitie and chellous (fissuring at corners of mouth and hips.	Turnip mik eggs yeest vegetebies hver kidney
\mathbf{B}_{σ}	Pyridoxine	Dermetatia and consultrions.	Yeart milk meet fish, eggyolk whole rereal, grams
B ₁₀	Cyanocobaminica	Pertucions especime RBC referency in bosmoglobin inflormmetron of tongrie and mouth	Ment, eggs, liver of ox, theep, pig, fish, curd, etc.
£	Ascorbic acid	Scurvy according of gums pyorrhes constraint and bleeding of certif	Ciurus fruns alte orange, lenum, anna, conam, green vegetablea.
T)	Ergocolmiarol	Rickets bone deformities or children and osisimalarus soft bones and joint parte in adults	Malk egg yolk, cod over ad exposure in stadight.
E	Tomferol	Stenaty	Ous ake cotton seed on soyabean oil when grain oil sunflower oil.
К	Phyllogianone	Haemophical finemembegic condition occased bood clothing lame	िशनकोत्त, हुम्मस्य स्थिष्टि पश्चुस्थानोशस्त
H	Brotan	Dermstatis, lose of pair and paralysis.	Yeast hver kidney and mak
Q_{n_n}	oenzywe	Low order of minimity of accy against many diseases	'horoplasts of green plante and untochondris of animals



Sources. Green easy vegetooies soyabean cobbage vegetable oils spansch, tomatoes.

The deficiency of vilamin K causes haemorrhage, lengthens the time of blood clotting

13. Coenzyme Que

Sources. The main sources of coenzyme Q_{in} are chloroplasts of green plants and motochendria of animal.

The definiency of coenzyme \mathbf{w}_{ij} causes low order of immunity of body against many diseases.

Differences between Hormones and Vitamins

Both hormones and vitamins are required in said a amounts to bring but various metabour and physiological reactions in the body. These have some differences as given below.

	Hormones	Vitamins
1	These are chem: a, a maintees which are produced in the ductiess guinds in the body	These are not produced in the body except vitamin D) but have to be supplied in diet and are essential for proper functioning of the different organisms.
2.	These are not stored in the body but are contangously produced.	These may be stored in the body to fight out diseases.

NUCLEIC ACIDS

As you know every generation of each and every species resembles its ancestors in many ways. It was been established that the nutries of a fiving relias responsible for transmission of these characteristics biso called heredity from one generation to the next. The particles present in the nucleus of the cell which are responsible for transmission of nutries a articles are colled chromosomes which are made up of protein a roun mind with biomolecules known as nucleic ands Nucleat ocids are biologies. It important polymers which are present in all living cells.

They play an important role in the development and reproduction of all forms of life. They direct the synthesis of proteins and are responsible for the transfer of genetic information i.e., the hereditary character stics. The repeating nots of orcheic ands are called appropriate. Therefore, the nucleic acids are also regarded as polyamic relation. While proteins have a polyamic chain nucleic acids contain a polypeptide seter chain.

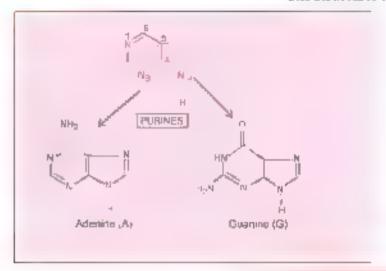
There are two types of nucleic acids

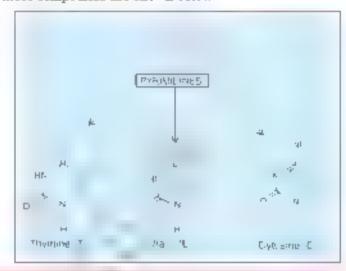
(i), DNA .deaxymbanisalesc ocid) (ii), RNA inbonuciesc and i

A nucleotide consists of three chemical components

- (i., A nitrogen containing heterocyclic base
- all a five carbon sugar
- tui) a phosphate group.
- 1. Nitrogen containing hotoropyclic base. There are two different types of heterocyclic introgeneous bases. These are known and purines and pyrimidines. Pyrimidines have a single heterocyclic ring while purines have two fused rings. The beterocycles present in nucleic acid are substituted forms of these compounds. The common examples are
 - (i) adenue (A and guarane G) are substituted purines
 - cytosine C). thymine (T) and uran. U are substituted pyrimidines.

The structures of these compounds are shown below

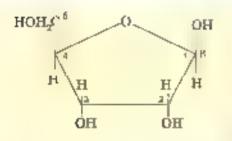




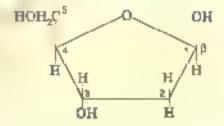
are found in both polymers DNA and KNA.

RNA contains uracil asteod of thymna present in DNA.

2. Sugars. There are two types of sugars present in nucleic scids. The sugar present in RNA is 6-D-ribose and in DNA is 6-D-2 depaymbose as shown below



β-D-Ribose (a sugar present in RNA.



β-D-2-Deoxyribose (a sugar present in DNA

A phosy matiger or. These are responsible for the linkage in nucleic acid, polymers.

The phosphate group in nucleic acid is

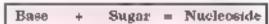
Phosphate unit

The phosphate group is bonded to a hydroxy group of sugar

Nucleosides and Nucleotides

Nucleosides

The motorures in which one of the a regen bases, pursue or pyramidate is bonded with a sugar molecule is called **aucleoside**.

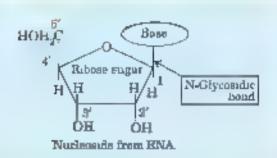


The nucleosides of RNA and DNA differ in two respects

- . The sugar in RNA nucleoside is riboso while the sugar in BNA nucleoside is decoxyribose.
- The nucleoside of RNA contains urand base in place of thyranic present in DNA.

REMEMBER

The suffix a-deaxy it are name of 2-deaxymbose means the in acks an oxygen at position-2



It may be noted that in nucleosides, the carbon atoms of sugar molecule are numbered as 1 2 8 4 5 exc. In order to distinguish these from the bases. The purme or pyrimidine bases are attached to position I of pentoses through N-glyposidic linkages.

The nucleomies are named depending upon the base present as

Base	Abbreviaudo	Nuc' enaide
Adamine	A	Admosms
Granine	G	Guancaine
Cytosine	G	Cytadine
Thymine	T	Thymidine
Uracil	υ	Undine

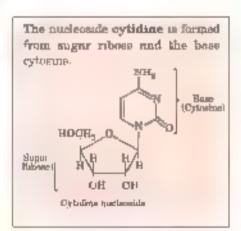
Nucleotides

When the phosphate group is attached to the aureenade the compute of formed is called nucleotide. In other words, a nucleotide is a phosphate ester of nucleoside as discusses of a purme or pyramite base, the 5-carbon is gar and one or more phosphate groups.

Thus, a nucleonde contains a sugar unit unked to mirrogen base and phosphate group unit. Their structures are shown below

Adequaine conophosphate (a pudeotide

In nucleoudes, the sugar rings are attached to the introgen atom of the heteroryolloring by a bond between T, atom of sugar and nitrogen atom of



heterocyclic ring. This linkage, a call of **glycosidic bond**. The phosymate group is bonded to a hydroxyl group of sugar.

The projection are observated by three countal exters preceded by d- at case of decay series. For example

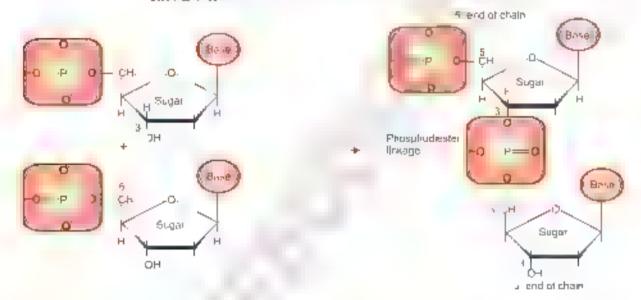
AMP Adenosine monophosphate

DMP Decrysdenosine manaphosphate

ATP Affenosine triphosphate

UDP Undate diphosphate

Nucelotides are joined together by **phosphodiester linkages** between 5 and 3' carbon atoms of peniose sugar. The forms and of a disucleotide is shown below.



This may be simplified represented as

Fhosphate

Sugar

Phosphate

Sugar

Sugar

Sugar

Sugar

Sugar

Sugar

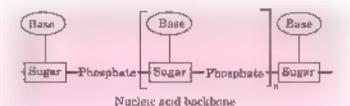
5 end

Therefore, the consecutive joining of sugar unit of one nucleotide to the phosphate group of text nucleotide results in a long their polymer called nucleic acid. Anucleic scid chain is commonly abbreviated by a one letter code with the 5 end of the chain written on the left side. For example, a tetranucleotide having adenine, cytosine, guanine and thymine bases from 5 end to 3 end is written as ACGT.

The back one of the nacted and consists of a termaning at gar and phosphate bonds. For simplicity, the bases are represented by their respective symbols, the phosphate round at epicsenced by the symbol. If and sugar is drawn acroiting to simple Fischer projection. For example, the tetranacleotide AutiT can be written as

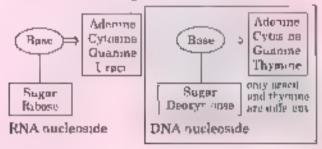
BIOMOLECULES

Thus, the nucleic acid backbone consists of a terrate sugar-phosphate residues from of the four retrogen once residues is attached to each organi out on this backbone. The nucleic acid backbone is shown below



Summary of Nucleic Acids

Base and sugara form Nucleosides



⇒ RNA contains urace, while DNA contains thymine, other bases are same Nucleosides joined to phosphate group form ancleotides. The polymers of audioutides are nucleic acids.

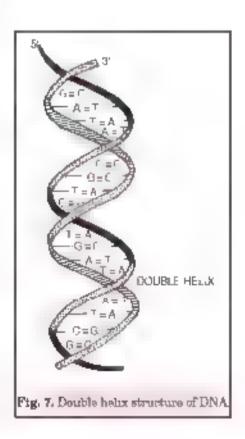
STRUCTURE OF DNA

1 Primary Structure of DNA

The sequence of nucleoides with the charm of nucleoides its primary structure. It was found by E. Chargeff that the case inaposition in DNA varied from one species to other species. However, it is easier to that of thyrinite (A = T) and the amounts of cytosine was equal to that of guarante = G. This is also known as Chargeff rule. In other words the total amount of purious was equal to that of granules of purious was equal to that of primary and about 0.98 to E. Con.

The three dimensional structure of LNA was elucidated by James Watson and Francis Crick in 1953 on the basis of X-ray diffraction studies. Watson and rick proposed that DNA polymers have double helical structure, which explained not only the base equivalence A = T and b = C but other properties of DNA especially its duplication in a in ingred called replication. The double helical structure of DNA is shown in Fig. 7.

This double helical structure of DNA consists of two right handed helical polynoricolade chains coiled around the same central axis. The two strands are anti-parallel (ε) their $\delta \to 3$ phosphodiester linkages run in opposite directions. These two strands are marked δ and δ which indicate that the free hydroxyl groups of the terminal decryphose aritis are present at δ and δ positions respectively. Therefore, a linear polymer has a free δ -hydroxyl group at one end and a free δ -hydroxyl group at other end. The nucleotides making up each award of DNA are connected by phosphate cotor bonds. This forms the breakbone of each LNA strand from which the bases extend. Fig. 7. The bases purmes and pyromidines are stacked inside the helix in planes perpendicular to the helical axis. It is take a stack of flat plates held together by two ropes of sugar-phosphate polymeric backbone running along outside of stack. The bases project towards each other within this structure, while he argan and phosphate components form a structural framework on the outside of the display. The bases, thus are the steps of the appear star case and the argan phosphate framework is



the roong. Such a structure is called **double helix** structure. The order in which bases notion is called the **base sequence**. As a convention, the bases are abbreviated by the first letters.

2. Secondary structure of DNA

The two strands are held together by hydrogen bonds. This hydrogen bonding is very specific because the structures of bases permit only one mode of pairing. For example, guantine is bydrogen bonded to cytusine and adenine to thymine. Thymine and adenine can be joined by two hydrogen bonds white cytosine and guantine can be joined by three bydrogen bonds. This has been shown in Fig. 8. No other combination of four bases is possible because these do not lead to strong hydrogen bonds.

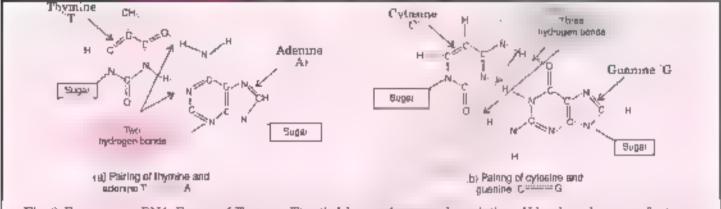


Fig. 8. Base pairs in DNA. Pairing of Thymine. Theirth Adeims. As sectors through three H-bonds and pairing of cytomic.

C) and Guanne. G) occurs through three H-bonds.

REMEMBER

- Adenne and Thymme form two hydrogen bonds with an overall strength of about 42 kJ cm⁻³
- Guenne and Cytosine form directly drogen bonds with overell etrength of 800%.

The two strands may be represented as

Strand I	A	T	T		A	A	- (
				3			E E	
Strand II	T	C	A	G	T	T	C	

It may be remembered that only A and T and G and C can combine. A and T are often by we hydrogen bunds wate I and C are joined by sures being gen unde In a ld top to sydrogen bottle outer forces such as a vdropholic interactions between stacked cases are also responsible for stanisty and maintenance of double beby

The two stranes of DNA are said to be complementary to each other in the sense that the sequences of bases in one strand automatically determines that of other. For example, whenever adenine A appears in one strand a thymne (T) appears opposite to it in the other strand.

The diameter of double behat is 2 am and the double behad structure repeats at interval of 3.4 nm when it completes one burn. This one turn corresponds to ten base pairs. ENA belies can be right banded as well as left banded. The β -conformation of I NA having right handed beliess is most stable. In heating the two strands of DNA separate from each other and this process is known as melting. When these two strands are cooled they again bybridize. This process is called annealing. The temperature at a bich the two straids completely separate is known as its melting temperature (Γ_m . This is specific for each specific sequence.

SOLVED EXAMPLES

■ Example 3...

In E. cos. PNA, the AT/GC ratio is 1.08. If the number of motes of adea are its DNA sample are 465.000 calculate the number of moles of guarante present.

Solution. We know that the number of moles of adenine should be equal to these of agrains. Therefore

$$A + T = 2 \times 465,000 = 930,300$$

B. ow

$$A + T/G + C = 0.03$$

$$G + C = \frac{A + T}{0.95} = \frac{930,000}{0.93} = 1000,000$$

Now males of guarante should be equal to cytosine

$$G = \frac{1000,000}{2} = 600,000.$$

■ Example 4-

A DNA molecuse with more number of x, base pairs than AT base pairs has higher T_m than the one with sesser number of GC base pairs than AT base pairs, Explain why!

So where JNA molecule with more number of GC base pairs than AT base pairs has angher T_{n} because GC base pairs having 3 systrogen bonds compared to AT base pairs having only 2 hydrogen bonds results in stronger binding. Therefore, T_{n} is high

■ Example 6...

Two samples of DNA, X and Y have melting temperature T_{m} as 340 and 350 k respectively. What it, the data indicate regarding their base content.

N.C.E.R TA

Solution: We know that GC are held by triple hydrogen bonds while AT are held by two hydrogen bonds. Therefore 4.4° base print results into etronger bonding. Thus, the sample Y having higher $T_{\rm eff}$ must be having more. Let content as compared to supply X.

Structure of RNA

The structure of RNA is similar to that of DNA except that it is a single strand structure. Sometimes, they fold back or themsen is to form a double near structure. RNA molecules are of three types and may be form inflared a functions. They are named as

() messenger RNA + m-RNA

a) ribosomal RNA . r-RNA
a) transfer RNA , t-RNA

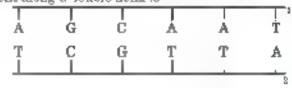
BIOLOGICAL FUNCTIONS OF NUCLEIC ACIDS

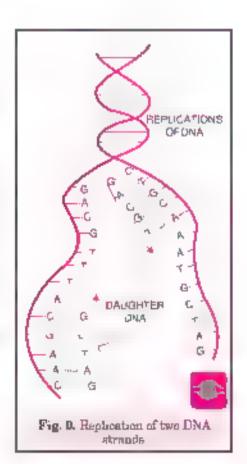
DNA is the chemical basis of heredity and may be regarded as the reserve of genetic information. DNA is exclusively responsible for maintaining the identity of different species of organisms over mail or softyears. The important biologum, functions of nucleic ands are

1. Reolication

It is the property of a molecule to synthesise another molecule. DNA has a unique property to displicate or replicate itself i.e. it can bring about the synthesis of another DNA in the Hephanion of DNA is an enzyme case year process. In this process, at the time of religious or milosis, the two strands of DNA dot bis hear partly inwind and each strand serves as a template or pathern for the synthesis of a new in NA indicate is strand. Due to unique specificity of time pairing the new in the shared complementary straid in each case is an exact copy of the originally separates from it. As a result, two double stranded DNA molecules are formed capied two daughter DNA molecules. One of the strand somes from the parent DNA molecule and the other is new visynthesise. Each DNA is exact replica of the parent. In this way, hereditary effects are transmitted from one cell to another. This is shown in Fig. 9.

It may be noted that DNA replication follows the base pairing rules by which A pairs with T and G pairs with C. This reputation can easily be understood. Suppose a segment along a double hear is





When this double behy ancous, then it forms two strands as



Each strand can act as a semplate to build identical double believe. The complements to the two strands are



These two dot be believed are identical to each other and withe first buible. heir. Thus, the original double belix is repeated ...self.

The DNA replication as semi-conservative remain and the parental LNA is conserved and only one strand is synthesized. DNA replication takes place only in the 6 +3 direction.

2. Pro ein Synthesia

DNA molecules also perform an important function of synthesising proteins, which serve as machinery of the aying cell. In this process, the generic information codea in DNA in the form of specific base sequences is transfored in a supressed n the form of sequence of amino acids which result in the synthesis of specific proteins which perform various functions in the cel. Actually the proteins are synthesised by various RNA molecules in the cell but the meson ge for the synthesis of a particular protein is coded in DNA.

Protein systems is a fast process and about 10 Januar was are added in one second. For example, saik has the major component forms protein. A single floroug gene makes 20° copies of its m RNA is die. in m RNA produces 20° moter des if fibron, protein amounting on the F 100 molecules of protein. per cell in a period of 4 days.

Differences between DNA and RNA

The important differences between DNA and RNA are

DNA	RNA
It occurs making in the modeus of the cen	It occurs at the cytopiesm of the cell
** It has double stranded &-helix structure is which two a rands are colled spirintly in opposite directions	It has single stronded u-helix structure
The sugar molecule in 2-densymbose	The sugar molecuse is ribuse
 N regeneus base araci: s not present 	Nitrogenous base thymane is not present.
 DNA has the unique property of repleasion. 	RNA isonity does not replicate

 It is responsible for the granamission. for heredity character.

INA molecules are very large, here molecular masses may vary from 0 = 100 10 = 100 a

RNA morecules are much amader with molecular mass ranging from "A R IN A R IN THE

Helps to protect hipsynchesia

Rompetition Plus

- LIPIDS are only, fatty or waxy substances present in ving organ sms Tley form part of structure of biological membranes and store energy for
- O CELLULAR MEMBRANES are constituted mainly of phusphulipide and chalines For desail refer Competition Fite. (prigte 65)

DNA Fingerprinting

Every individual has unique fingerprines These occur is the tipe of the flogers and have been used for identification for a migme Hawever these may be changed by surgery. The rangue fingerprints are due to inique sequences of ossess on DNA for every person. The difference between people or animals is the difference in the neder of the base pairs. There are so many minimas. of base pairs in each person's DNA that every person has a different sequence. This techn que for edent by up no name person organ am based upon the an queness of that DNA portors is called DNA fingersymptong, it is same for every cell and cannot be altered by any known creatment It may be noted that the patterns do not give on individuafingerproma out they are able to acteruage whether two DNA sample are for the same person, related person or non-related

The important uses of DNA ingerprotong are

- t) un forensic aboratories for identification of innocence or guid. وعوول بهرستينات ديد
- to determine paternity of ການ ການປະຊານ ແລະ
- as an identify dead bodies in any accident by comparing the DNAs prints of parents or
- t to identify racial groups to rewrite baological evolution

Learning Place

Gene. Each segment of a DNA molecute that codes for a specific protein or a polypeptide is called gene.

Genetic code. The relation between the nucleof de implete and the amino acids is called the genetic code.

Mutation. It is a chemical change in the sequence of introgenous bases in DNA molecule that could lead to synthesis of proteins with different among and sequence. The changes in DNA molecule can occur spontaneously or a may be caused by including, chemical agents or viruses. Must of these changes in the LNA molecule are a normal casty repaired by special enzymes in the cell. The altered proteins on used by incoming may lose their biological artivities and thus causing the death of the cell. The defective generical cause abnormalities or diseases.

GOLVED EXAMPLES

Example 6. —

What until be the sequence of bases on the strand of DNA that would be complementary to strand having the following sequence of bases:

AATCGTAGGC

Solution: We know that adenine (A) passe only with thymine (T) and cytomae (C) pass only with guanae (C), we can write the acquence of bases as

Original A A T C G T A G G C strand

Complementary T T A G C A T C C G strand



O

N

C

E

P

T

U

А



Q.1 (a) Which vitamin deficiency causes rickets?

(i) Name the base that is found in nucleotide of RNA only.

(Karnalnka S.B. 2018) (CBSE Sample Paper 2017-18.

Ana. 6 Vitamin D

6.2. How many naturally occurring amino acids in proteins exist? How many of these are synthesised by the body?

Ans. There are 20 amino ands in proteins, 10 out of these can be synthesised by human body

Q.3. What is the difference between DNA and RNA on the basis of bases they contain?

Ans. Both DNA and RNA common two cases derived from purios, guarante and adenuse and one base derived from pyrimidine cytosine. However they have fourth different base. DNA contains shyrome whereas RNA contains some

Q4. State differences between primary and secondary structure of proteins.

Ans. The order is which the animal acids are joined to one or more polypeptide chains of a protein is caused primary structure. It gives its function and is critical of its biological activity

The secondary structure determines the manner in which the protein chain is folded lit arises from the planar geometry of the poptide band and hydrogen bonds between one region of the backbone to another

Q.5. Which a-amount and can cross link peptide chains ?

Ans. Cysteine can cross link peptide chains farough disulphide bands

Q.S. State the use of interferon and insulin in medicines.

Ans. Interferm is an automal agent Insulin is used in treatment of diabetes.

Q.7. What type of linkages hold together monomers of DNA 7.

(Assom S.B. 2018)

Ans. Hydrogen bonde

Q.8. What are the main functions of the hormone advending?

Ans. The main functions of adrenaline are

It increases the pulse rate and blood pressure.

(a) It releases glucese from glycogen and fatty acids from fate.
Q.9. Which enzyme is present in salva? What is its function?

(H.P.S.B. 2012)

Ans. The suzyme present to salve as anylose It hydrolyses starch into moltose

Q.10. Which of the following is not an e-amino soid?

Cysteine, Tyrosine, Trypsin, Proline, Serine

Ans. Trypain

Q.11. What are non-essential amino ands? Give one example.

(Assam S.B. 2017, H.P.S.B. 2018)

And The amino soids which can be made by our bodies and are not required to not thet are called non-essential amino amils. For example, glycine

Q.12. How are nucleosides, nucleotides and nucleic acids related?

Ans. Nucleosides joined to phosphate group form nucleotides. The polymers of nucleotides are nucleic acids.

Q.13. What is prosthetto group?

Ans. A prescribetic group is a non-pressur parties obtained by hydrotypes of compage ad proteins. The mean function of the prescribetic group is to control the biologuest functions of proteins.

Q.14. What is the function of enzyme present in liver?

Ans. The enzyme present in liver converts galactose to glucose.

Q.15. Fresh tomotoes are a better source of vitamin f than those present to tomotoes which have been stored for some time.

(Manipur S.E. 2017)

Ans. On prolonged exposure to air vitamin "O preser or stored tomatoes is destroyed due to its aemai conduction

Q.18. Name the enzyme which converts sucrosse into glucose and fructose. (Pb.S.B. 2005, 2012)

Ann. Invertose

Q.17. Name the enzyme which converts

i) maltose into glucose (ii) glucos

(ii) glucose into alcohol.

(Pb.S.R. 2012)

Ane. (c) Meltage

(й Тушпав.

4).18. What is hypervitamineses and avitamineses ?

(Pb.S.R. 2012)

Ans. Excess intake of vicamins A and D images hypervitaminases. Multiple deficiencies caused by lack of more than one vitamins is called systeminoses.

Q.19. What is coenzyme ? Give one example.

Ans. The non-protein component of an enzyme which is invasly held by one enzyme and to essential for its biological activity is called a configure. These are mostly derived from vitamine such as therefore B_i) ribotlavia (B_i) etc.

Q.20. What is isoelectric point 7

(Ph. S.R. 2005.

Ans. The pH of which no net augretion of animo and takes place under the influence of an applied electric field is called isoelectric point. For example, isoelectric point of glycine is 6.1

Q.21. Name the vitamins in each case whose deficiency causes

sight blindness (ii) poor coagulation of the blood.

(C.B.S.E. Sample Paper 2016)

Ans. (. Vitanim A ... Vitanim K.

Q.22. Amino neids have high melting points and are soluble in water. (C.B.S.E. Sample Paper 2010)

Ans. Amino ands have high metang points and are soluble in water because these exist as zwitter into or dipolar sons as

Because of dipolar ones, there are strong internanceular forces in crystals and they behave as tonic compounds

Q.25. What is meant by the secondary structure of proteins?

(C.B.S.E. Sample Paper 2010)

Ans. The secondary structure gives the manner in which polypeptide chains are folded or bent. This arises from the piane geometry of the peptide bond and hydrogen band between one region of the backbone is another.

Pauling and Corey investigated the structures of many proteins with the help of X-raye patterns. It was observed that in many proteins, polypeptide chains are could up in the form of a spirel standard called behix or conclin. The behical shape results from the formation of hydrogen bonds between among ands in the peptide chain. This structure can be imagined as if one can could polypeptide chain around an investile cylinder.

In addition, the another type of secondary sururtures are also known such as fl-pleated sheet and triple belix.

Q.24. Give one example each for essential and non-essential amino acids.

CHSE Sample Paper 2011)

Ans. Essential amino and Value

Non-essential amino acid glycine

Q.25. Differentiate between kerntin and insulin-

(BSE Sample Paper 2011

Ano. Keratin is a fibrous protein while insulin to a globular protein.

Q.26. Write the Zwitler ion structure of glycine.

CBSE Sample Paper 2011, Karnataka S.B. 2018)

Q.27. What type of forces are responsible for the formation of β -plented sheet structure? H.P.S.B. 2012):

Ans. Hydrogen bonds

Q.28. Write the chemical name of vitamin B_{co}-

Micorom S.B. 2012

Aris. yantocobetamine.

Q.29. What is the chemical name of vitamin C and which disease is caused by its deficiency?

(Pb. S.B. 2018, H P S.B. 2017)

Ans. Astorbic acid, deficiency disease. Beurvy

Q.30. What is the chemical name of vitamin A and which disease is caused by its deficiency? 4Pb. S.B. 2018

Ans. Retinol deficiency disease. Xerophthalinus

Q.81. What are three types of RNA molecules which perform different functions?

Ans. Messenger RNA or-RNA -thosomal RNA r-RNA and transfer RNA / RNA.

Q.38. Vitamin C is found in fruits and vegetables. It cannot be stored in our body. Why?

(Kerolo S.B. 2012, Megholovo S.B. 2017)

Ans. It is soluble in water and excess of it is readily excreted in urine.

Q.83. Name the vitamins whose deficiency cause of rinkets or night blindness, (iii) sourcy.

(Manipur S.B. 2011

Ans. (c Vitamin D (ff) Vitamin A (ar) Vitamin C

Q.84. Which among acid is not optically active?

Meghataya S.B. 2018)

Ans. Glymne NH, CH, NOOH

Q.85. Name the metal present in vitamin B. o.

(H.P.S.B. 2018)

Ans. Cobait.

Q.88. Name the mitrogenous base present in RNA but not in DNA.

(Karnataka S.B. 2018)

Ans. Urani

Q.87 Name one fibrous protein and one globular protein.

Megholova S.B. 2018)

Ans. Fibrous Kerntin

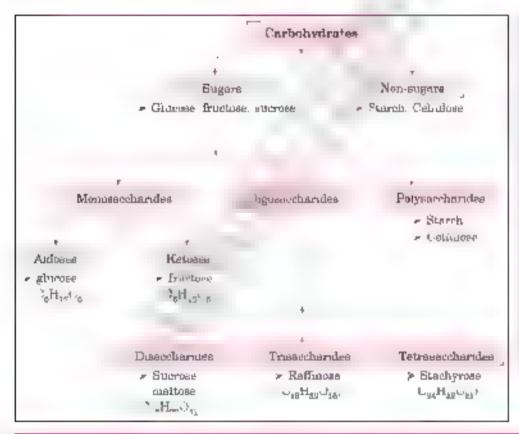
Globuser Achumun



Key Terms & Laws

- Carbohydrates are polyhydroxy aluebydes or herones having the general formula, C_i, H.O_i, and are altimate sounts of our food
- Anomers. The pair of option isomers which differ in the configuration only around to atoms * ε * * * always and β-reglacese.
- Mutarotation. The spontaneous change in specific rotation of an optically active compound with time to an equilibrium value.
- Invert sugar. The change of sign of rotation on hydrolysis of sucross is called inversion reaction and the mixture, glacose and fructose is called invert sugar.
- Ameno acoda are organic compounds containing both amino group. NH₂ and carbixyles and group. COOH.
- Proteins are complex rong polymers of ammo ands miked by -CO-NH bonds.
- Enzymes are biological catalyte produced by aving cells which catalyse the montanical reactions.
- Vitamins are essential components of our diet.
- Nuclear acids are monucleomes which are found in the nuclei of all hong cells of the form of nucleoproteins.
- Materion The chemical change in a DNA molecule data would lead at synthems of newtons with different among and sequence
- Replication The process in which duplication if DNA takes place during not division.

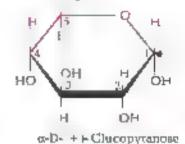
QUICK CHAPTER ROUND UP



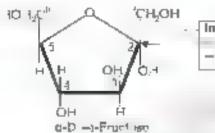
Raducing sugar which reduces Proling solution or Tollenie reagent They coutem H Ċ=0 ÓН g-Hydroxyncetaldehydo **Ervuu** OH n. Bydnayketone gruup e.g. D-glucose. D-fructose, maltose, Inchose. Non-reducing sugars which donot reduce Fehring solution or Tollen's reagent These denot contain free aldehydic or ketonic group with OH group on the edjacent to carboxyl group e.e. Sacrose in non-redocing sugar

The ankage between two monosocchande units through O atom is called glycosidic linkage.

Haworth projection formulae CHOH



Class ap —His down



in \$-/ocm — Of is ap —CH₂OH is down

The pairs of optical isomers which differ in the configuration only around C_{λ} are anomers

- Starch is polymer of tt-D glucose units and consists of two components
 amylose
 amylopectin
- Cellulose, polysacchande of β-D-glucose units joined together by 1, 4-glycosidic ankage

Amuo aeida



- > sendir character is due to 'NH' group
- hear observater is due to 4000 group.

Isoelectric point - pH at which there is no net charge

Peptides

Peptides are compounds formed by the condensation of two or more c-amino edus.

Densituration of proteins: A process which changes the physical and biological properties of proteins. The densituration is caused by changes in temperature, pH, str.

- departmention compare change in spendary and technic structures but primary structure remains intest.
- congulation of egg whole on boiling, curdling of milk, formetion of cheese

PROTEINS: Polymers of sound seeds held by peptide f GO NH indeeque

Fibrous proteinst polymentide charas non parallel and are betd by hydrogen and distribute bunds fibro ske structure - kerama myosar fibran

Globular proteins polypephde chams con around to give a spherical shape.

ringulin #locaning

Structure of proteins

- Primary structure gives the sequence in which n-ammo ands are held together in a protein.
- Becondary structure gives the manner in which the polypeptide chains are folded or arranged. These are of two types.
 - Othelix structure
 - □ B-pleated structure
- Tertiary structure arises due to folding, coding and bending of polypeptide chains giving three dimensional shapes. Two major shapes are fibrous proteins and globular proteins.
- Quaternary structure gives the sub-units and their spatial arrangement with respect to each other

ENZYMES are biocetalysts produced by dving cells. Chemically enzymes are noturally occurring simple or conjugated proteins.

Deficiency of ensymes enuses diseases

- phenylmianine hydroxylmse course disease phenyl kewnie tires
- куговоляве се овек фиселяе воблотем;
- Enzyme streptokunase is used to dissolve blood clot to prevent heart attacks

HORM NES Chemical substances which are produced in the durtiese glands in the body

в спе оченеве вилие из не ожу						
Sterand	Peptide	Amine				
hormones	h curmortes	hormones				
 Teetrebijning 	 bythem 	 Adrereline 				
 Estrogena 	- Vaeonnesein	 Thyroxine 				
 Progesterone 	 Intettlut 					
 Cortuine 						

- insulin produced in parameter controls the glucose level in the blood.
- Thyroxide produced in thyroid glaude controls; metabolism of carbobydrates, upda and proteins.

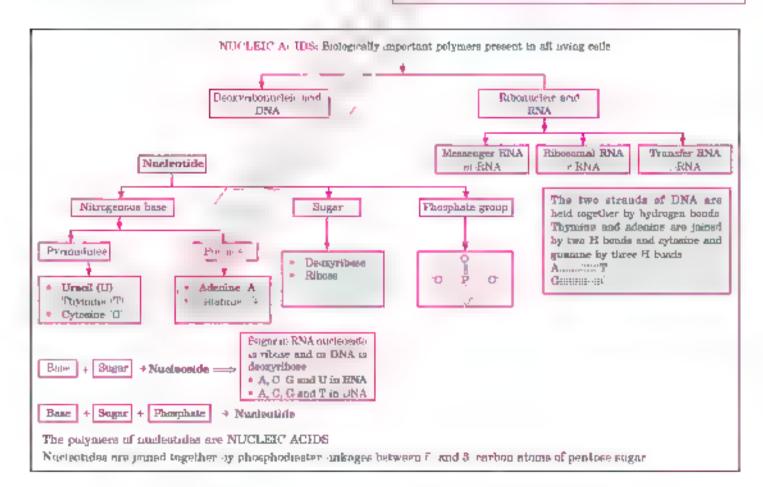
VITAMINS: Organic compounds required in the dist to perform specific biological functions for the normal maintenance of optimum growth and health of the organism

Pat soluble: A, D, E and K stored in liver and adipose for storing beauce.

Water soluble C. H group cannot be stored to the body

F The deficiency of vitamins causes discases.

Vitamin	Chemical name	Disease
Α	Retinal _	Night blindness or xemply tinimin
B ₁	Thiamine	Ben-ben
B ₂	Kihalla 🕠	Treflorat, digestive disorders
В	Pyridox-me	Dermetska, convinsiona
B ₁	Сув тогободоть по	Регимоне валеши
	Ascorbus acid	Sci rvy
L	Ergoranoderos	Richets
E	Toentero!	Stanlity
K	Phylogomone	Haenuphiha
H /	Broten	Dermetatie









NCERT

In-text Questions



- O.1. Glucose or sucrose are soluble in water but syclohexane or benzing (simple six membered ring compounds) are insoluble in water. Explain.
- Ana. Glucuse and sucrose are polar in nature and become are soluble to polar water. On the other hand, cyclohexage and, benzing are non-polar and bence are not soluble in water.
- Q.2. What products are expected when inclose is hydrolyned?
- Ans. Lectors on hydrolysis gives β-D-galactics and β-D-glumse.

$$\begin{array}{ccc} C_{13}H_{12}O_{13}+H_{2}O & \xrightarrow{H_{2}destropin} & C_{3}H_{12}O_{6}+C_{6}H_{12}O_{6}\\ & Lacture & Galactore & Incose \end{array}$$

- Q.3. How do you explain the absence of aldehyde group in the pentagostate of D-glucose?
- Ans. The perceacetate of glucose does not react with hydroxylamine (NH_sOH) which shows that aldehyde -CHO) group is not present in glucose pentascetate.
- QA, The melting points and solubility in water of aming acids are generally higher than that of corresponding haloacids, Explain.
- Ann. This is due to dipolar or switter ion structure of ammoacida.



- Therefore, also some compounds, emino ands have strong electrostatic attractions and bence have high melting points and are highly souble in water
- Q.5. Where does the water present in the egg go after builing the egg?
- Ans. When on egg is boiled in water, the water present in egg is used in denaturation of protein probably through H-bouring. In this process, the globular protein in egg. changes to rubber like insoluble mass.
- Q.8. Why vitamin C cannot be stored in our body?
- Ane. Vitamin C remot be stored in our body because it is soluble in water and is readily excreted in urine and cannot be stored in our body
- Q.7. What products are formed when a nucleotide from DNA containing thymine is hydrolysed?
- Ams. 2-decay-D-ribnee, thymune and phosphoric and
- Q.S. When RNA is hydrolysed, there is no relationship among the quantities of different bases obtained. What does this fact suggest about the structure of RNA?
- Ane. This suggests that there are different types of RNA molecules which contain different quantities of bases.



NCERT

Textbook Exercises



- gavectose monosacchande tructase mondencehande mellbee. disacchande.
- Q.5 What do you understand by the term glycosidic linkage?
- Area. The condensation of hydroxyl groups of two monosarch andes. to form a link between them is called glycosidic linkage See structures of disacchandes.
- Q.8. What is glycogen? How is it different from starch?
- Ane. Glycogen is a polyearchande found in all sounsi cells mainly in muscles and liver. It serves as a reserve carbohydrate of animals and hence is known as animal starch. It is a polymer of about thousand glucose units arranged in the form of highly branched chain
 - On the other hand, starch is a principal food storage of glucose energy. Starch is a polymer of the-glucose. consisting of two components amylose and amylopectin
- Q.7. What are the hydrolysis products of i) sucrose and (ii) lactose?
- Arts. (r. Glucose and fructose $C_{10}H_{20}O_{11} + H_{2}O_{-erinversas} + C_{6}H_{10}O_{6} + C_{6}H_{12}O_{6}$ Sucrace

Q.1. What are monosaccharides?

- Ans. Monoecchandes are polyhydric aldehydes and ketones which cannot be hydrolysed asta sampler carbohydrates. The monosaccharides with aldehydro group . - CHO are called aldoses while those with betonic group C:C=O are called ketoses. For example, glurosa, fructosa, ribose, etc.
- Q.9. What are reducing sugars?
- Ans. The sugars which can reduce Tollen's reagent or Fehling's solution are called reducing sugars. They concern a characteristic group either aldehydic group (-OHO) or 0-ketal group -CO-CH_CH). For example, glucose. geractose, fruntose are reducing augera.
- Q.f., Write two main functions of carbohydrates in plants.
- Ann. 1 Carbohydratea except cellulosa) work as body fuels and act as the main source of energy
 - The polyesechande cellulose acts as chief structural. material in the cell walls of the plant cells
- QA. Classify the following into monosaccharides and disacobacides, Ribose, 2-deoxycibose, maltose. galactose, fructose and lactose.
- . monosaccharide Ans. Rigosa 2-Theorgrafbose nionosocchamida. dissochande maltose

(ii) D-gluccae and D-gainetose

Q.S. What is the basic structural difference between starch and cellulose.

Ans. Starch emissis of two components—amylese and amylesectal Amylese is a long linear polymer of 200–1000 cs-D-++-glucose units held by \mathbf{O}_{1} - \mathbf{O}_{4} glycosidic linkages it is soluble in water. Amylesectal is a branched chain pulymer of a-D-++-glucose linkages whereas branching occurs by \mathbf{C}_{1} - \mathbf{O}_{6} glycosidic linkage. It is insoluble in water.

On the other band corrupose is a straigh which polyserchands composed only of β -D-++-glucose units which are formed by glycosidic linkage between \mathbb{C}_1 of one glucose unit and \mathbb{C}_4 of next glucose unit

Q.B. What happens when D-gluonec is treated with the following reagents?

(i) HI (ii) Bromine water (iii) HNO₂

Ans. (i) When glucose is treated with HI it forms n-bezone, suggesting that all the six carbon atoms are maked in a streight line

(i) On benting glucose with bromine water, it gets oxidesed to an cerbon cerboxyle and glucour and.

(i): Glucose on treatment with intric and gives a disarburghe scid, seediaric and

Q.10. Enumerate the reactions of B-glucose which cannot be explained by its open chain structure.

Ans. Open structure of D-glucose model out explana the following reactions:

- Despite briving the aldebyde group, glarase does not give Schiffs test and 2, 4-DNP test
- μ) Glucose does not react with sodium by drogen sulphite to form addition product
- (a) The postessetate of glavere door not reset with hydraxyl amine showing the absence of free -CHO group. Φ When glucose is heated with methanol in the presence of dry HCl gas, it forms two isomeric monomethyl derivatives known as α-D-glucoside in p = 105°C) and β-D-glucoside in p = 107°C). Since only one molecule of methanol is used for the formation of methyl glucoside, these must be bemiscetals.

These results show that glucose does not have open chain. form structure

Q.11. What are essential and non-essential amino acids? Give two examples of each type.

Ans. The minor scide which can be made by our bodies and are not required in our diet are called non-essential amino ocide for example, givene and clanine.

The simula scide which cannot be made by our bodies and must be supplied in our diet are called sesential amino acide. For example, value and returne.

Q.12. Define the following as reinted to proteins. (i) Peptide linkage (ii) Primary structure (iii) Denaturation.

Ans. (2) Peptide Linkage Peptide band is formed by the condensation of two or more same or different n-samma ands. The condensation occurs between amino acids with the shimmation of water. In this case, the carboxyl group of one amino and and samma group of another amino acid get condensed with the elimination of water materials.

The resulting C NH linkege is called peptide (inkege is called peptide linkage is shown below

n Primary structure. The primary structure of proteins gaves the sequence in which the ammo acids are linked in one or more polypeptide chains of proteins. This is shown below.

22 Dennituration. A process that changes the physical and hological properties of proteins without affecting the chemical composition of a protein is called densituration. The densituration is caused by certain physical or chemical treatments such as changes in pH temperature, presence of some salts or certain chemical agents.

Q.18. What are the common types of secondary structure of proteins?

Ans. Common types of secondary structures are:

Ω n-behx structure , a β-picated structure
For details refer Text Pages 30 and 31

Q.14. What type of bonding helps in stabilising the v-helix structure of proteins?

- Ace. Hydrogen bonding between NH and $\dot{C} = 0$ groups of peptide bonds stabilise the 0-helix structure. Refer Text Page 30
- Q.15. Differentiate between globular and fibrous proteins.

Ans. Refer Test Page 29:

- Q.16. How do you explain the amphoteric behaviour of amino acide? (Kerula S.B. 2017)
- Ares. Due to dipolar or switter ion structure, amino ands are amphoteric in nature. The acidic character of the amino acids is due to the NH₀ group and the basic character is due to the COO group as shown below

Acidio elsaructer

Besie character

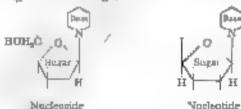
- Q.17. What are snaymes?
- Ans. The suzymes are biological catalysts produced by the aving cells which catalyse biochemical reactions in living organisms. Chemically enzymes are naturally occurring simple or conjugate proteins. For example, maltase anylase, invertase, etc.
- Q.18. What is the effect of donaturation on the structure of proteins?
- Are. During denotination, the protein molecule amous from an ordered and specific conformation into a more random conformation. Denoturation does not change the primary structure of protein but results from a rearrangement of secondary and tectuary structures
- Q.19. How are vitamina classified? Name the vitamin responsible for the congulation of blood.
- Ans. Refer Ten. Pages 38 and 40
 Vitamin responsible of congulation of blood is
 vitamin K.
- Q.20. Why are vitamin A and vitamin C essential to us? Give their important sources. / (H.P.S.B. 2017)

- Ans. Refer Text Pages 88 and 89)
- Q.31. What are nucleic acids? Mention their important functions.
- Ann. Refer Text Page 41:

Two functions of puries: scade are

- Replication u Protein synthesis Refer Section Pages 47 and 48:.
- Q.23. What is the difference between a nucleoside and a nucleotide?
- Ann. A nucleoside contains only two basic components of nucleic acids namely a pentose sugar and a nutrogenous base.

 A nucleotide contains all the three basis components of nucleis saids namely a phosphoric acid group, a pentose augar and a nutrogenous base.



- Q.23. The two strands in DNA are not identical but are complimentary. Explain.
- Ans. The bases of one strand of DNA are paired with bases of other strand through hydrogen bonding. The hydrogen bonding is very specific because structures of hoterocycles allow only one mode of pairing. The two strands of DNA are uniquementary to each other because the sequence of bases in one strand automatically determines that of the other
- Q.24. Write the important structural and functional differences between DNA and RNA.
- Ann. Refer Text Pages 45 and 48
- Q.25. What are different types of RNA found to the cell?
- Ans. The different types of MNA found in the cells are:

NCERT

Objective Questions from Exemptor Problems are guest in Competition File, page 88



- Q.1. Name the sugar present in milk How many monosoccharide units are present in it? What are
- Ares. Lectose is present is malk. It has two monnesechande units gloriese and galactose. These are called disaccharides.

such oligosaccharides called?

Exemplar Problems



Subjective Questions

- 2. How do you explain the presence of all the aix carbon alone in glacose in a straight chain?
- Ans. On prolonged heating with HI, glucose gives a begans.

Glucose
$$\xrightarrow{H_1}$$
 CH_3 — CH_4 — CH_2 — CH_4 — CH_3 — CH_3

This suggests that all the six carbon atoms are in a straight chain.

- 8. In nucleoside a base is attrohed at 1' position of sugar morety. Nucleotide is formed by linking of phosphoric soid unit to the sugar unit of nucleoside. At which position of sugar unit is the phosphoric soid linked in a nucleoside to give a nucleotide?
- Ans. Phosphorec scal is linked at 5' position of sugar numety of aucleoside to form a nucleotide

Nucleotade

- Name the linkage connecting monosaccharide units in polysaccharides.
- Ana. Glycosidie linkage
 - Under what conditions glucose is converted to glucome and saccharto acid^a
- Ans. Gluesse is converted to glueonic acid by Br_q water and in seccharge acid by cone. HNO₃.

- 6. Monosacchardes contain carbonyl group hence are classified, as aldoss or ketose. The number of carbon atoms present in the monosaccharide molecule are also considered for classification. In which class of monosaccharide will you place fructose?
- Ans. Fructose is a ketabezoae.
 - 7. The letters 'D' or 'L' before the name of a stereoisomer of compound indicate the correlation of configuration of that particular stereoisomer. This refers to their relation with one of the isomers of glyceraldehyde. Product whether the following compound has 'D' or 'L' configuration.

Ann. L configuration

8. Aldopentoses named as ribose and 2-deoxyribone are found in nucleic soids. What is their relative configuration?

Ass. D configuration

- Which sugar is called invert sugar! Why is it called so?
- Ans. Sucrose is called invertisager. The augar obtained from sugar beet is a colourless, crystaline and sweet substance. It is very soluble in water and its aqueous solution is dextrorotatory having |Q|₀ = + 66.5°. On hydrolysis with dilute ands or enzyme invertase, cane sugar gives equanolar muture of D4+1-glucose and D4-3-fructuse.

$$C_{12}B_{22}O_{33}$$
 + $E_{2}O$ + $C_{6}B_{12}O_{6}$ + $C_{6}B_{12}O_{6}$
Busine D4++Gluone D5 -Fructuse
 $al_{D} = +48.5$ $|al_{D} = +52.6$ $al_{D} = 92.4^{\circ}$

So, sucrose is destrurotetory but after hydrolysis, gives dextrarotatory glucuse and lasvarotatory fructuse. Diffusione has a greater specific rotation than Diffusione. Therefore the resultant solution upon hydrolysis is become attention of 4000°. Since there is change in the sign of rotation from destro before hydrolysis to lasvo ofter hydrolysis, the reaction is called inversion reaction and the mixture plucuse and fructuse is called inverting at the sign of rotation.

- 10. Amino noids can be classified as u., β., γ., δ. and so on depending upon the relative position of nmino group with respect to carboxyl group. Which type of amino acids form polypeptide chain in proteins?
- Ans. c-amuno acula, R-CH-COOH

NH.

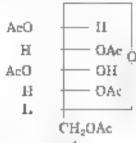
- 11 6-Helix is a secondary structure of proteins formed by twisting of polypeptide chain into right handed screw like structures. Which type of interactions are responsible for making the tehelix structure stable?
- Ans. In n-belix, a polypeptide chain is stabilised by the formation of hydrogen bonds between NH— group of amino acids in one turn with the pC = 0 groups of amino acids belonging to adjacent turn.
- 12. Some enzymes are named after the reaction, where they are used. What name is given to the class of enzymes which catalyse the oxidation of one substrate? with simultaneous reduction of another substrate?

Ans. Undereductase

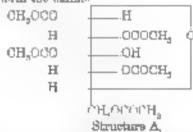
- During ourdling of milk, what happens to sugar present in st?
- Ans. Lactose changes to lactic acid.
- 14. How do you explain the presence of five -OH groups in glacose inviscule?
- Ans. Glucose gives pentacestate derivative on acetylation with acetylation cho

This confirms the presence of five OH groups

Why does compound (A) given below not form an oxime?



Ans. Glucose pentancetate structure A doesnot have a free -OH group at CI and therefore, cannot be converted to the open chain form to give -CHO group hence it doesnot form the cannot.



- 10. Why must vitamin C be supplied regularly in diet?
- Ans. Vitamin C is water soluble and therefore, excess of it is readily excreted in urins. Hence, it cannot be stored in unit body
- Sucrose is dextrorotatory but the mixture obtained after hydrolysis is factorotatory. Explain.

Since D4->fractors has larger specific rotation than D4++glucose the resulting mixture has specific rotation of 30.0° Therefore, the mixture is inavorotatory

- Amino acida behave like salta rather than simple amines or eurboxytic neids. Explain.
- Ans. In equeous solution, the carboxyl group loses a proton and amino group accepts a proton to form a dipular ion or switter ion

Structures of glycine and alanine are given below.
 Show the peptide linkage in glycylolanine.

Ans. In glycylalsome carboxyl group of glycine combines with the sname group of alsome forming a dipeptide as:

- H₂N CH₂ COOH + H₂N CH -COOH → H₂O CH,

 Hyritar Austrian

 O ×—Poptide linkage

 H₂N CH₂ C NH -CH COOH

 CH,
- Dysplaisance

 Protein found in a biological system with a unique three-dimensional structure and hological activity is called a active realisin. When a protein is its activity.

called a native protein. When a protein in its native form, is subjected to a physical change like change in temperature or a chemical change like, change in pH, denaturation of protein takes plane. Explain the same.

Ans. Due to physical or chemical change, the hydrogen bonds in proteins are disturbed the protein molecules uncoil from an ordered and specific conformation into a more random conformation. As a result, the protein loses its biological activity. This is called densituration of proteins

- 21. Antivation energy for the acid catalysed hydrolysis of sucrose is 6.22 kJ mol⁻¹, while the activation energy is only 2.15 kJ mol⁻¹ when hydrolysis is catalysed by the suzyme sucrose. Explain.
- Ans. Entymes act as brocatalysts and reduce the magnitude of activation energy by providing alternative path. In the hydrolysts of sucrose the suzyme sucrum reduces the activation energy from 6.22 kJ mol. 4 to 2.45 kJ mol. 4
- 22. How do you explain the presence of an aldehydic group in a glucose molecule?
- Ans. Glussee reacts with hydroxylamine to form a monorune and adds one molecule of hydrogen cyanide to give cyanohydrus.

Therefore, it contains a carbonyl group which can be an aldenyde or a ketons. On mild oudston with bromine water, glucose gives giveous and which is a carboxybe acid containing six carbox atoms,

This indicates that carbonyl group present in glucose is an aldehydic group

- 20. Which mostless of nucleosides are involved in the formation of phosphodiester linkages present in dinucleotides? What does the word diester in the name of linkage indicate? Which sold is involved in the formation of this linkage?
- Ans. When nucleoside is linked to phosphoric and at 5'-position of sugar mosety, we get a nucleotide. Nucleotides are joined together by phosphodiester ankage between 5 and 3' carbon atoms of the pentoes sugar.
 - 24. What are glycosidio hakages? In which type of biomolecules are they present?
- Ans. The unkage between two monoscrehende units through oxygen atom is called glycosidic ankage. It is present in disambarides and polysochandes.
 - 25. Which monosaccharide units are present in starch, cellulose and glucose and which linkages link these units?
- Ans. In starch 6-glucose units are present in cellulose \$-D glucose units are present in starch and glycogenglycosidir #imionge is present and in radialose glycosidir \$-imbage is present between glacose units
 - 26. How do enzymes help a substrate to be attacked by the reagent effectively?
- Ana. Active site of enzymes and due substrate molecule in a suitable position, so that it can be attacked by the reagent effectively
- Describe the term D- and L- configuration used for amon acids with examples.
- Ans. The expure are divided into two families—the L-family—and L-family—which have definite configurations. These configurations are represented with respect to give rability as the standard. The glycerable hydround be presented by two forms as



Differential the Proposition of the molecule of the Demission is a superstant of the desired to the certain adjacent to the certain of the molecule is related to a representative of the molecule is related to a representative of the molecule is related to a representative occurring angare being to Describer. Deglacuse Democre and Defractors

- 28. How will you distinguish 1" and 2" hydroxyl groups present in glucose? Explain with reactions.
- Ans. On oxidation with HNO₈, glucose as well as gluconic oxid, both give a dicarboxylic and, seccharic and This indicates the presence of a primary alcoholic (-OH group in glucose. The other -OH groups are recordary



- Congulation of egy white on boiling is an example of denaturation of protein. Explain in terms of structural changes.
- Ans. Congulation of egg white on boiling is an example of drunturation. This inherence when a prote o in subjected to physical change in temperature. The hydrogan bonds are disturbed. Due to this, globules unfold and helix get uncoiled and protein mass its biological activity.





MEMORY TEST



& Say True or False

- 1. Both glucose and fructous are reducing angurs
- 2. Lectura is an a-amino and
- 8. Starch has the components employe and amplopactin.
- Chemically denaturation does not change the primary structure of proteson
- The disease albinism is caused by the deficiency of enzyme byrosinase.
- 6. Uracii occurs in DNA and not in RNA
- Lactose on hydrolysis with seids gives gaisetose and fructuse.
- 8. Glycogen is a polymer of glucoes units
- u-Amon anda show basic character due to COO group and andic character due to NH₂† group
- 10. Both glucose and fructose form the same osazone
- 11. The synthesis of proteins is governed by DNA
- When glucuse is heated with methanol in the presence of dry HCl gas, it forms one methyl glycoside
- 13. Alemne and value are neutral transposands

- 14. Kerstin fibrom and collegen are fibrous proteins
- 16. Definency of vicenna D causes rickets.

B. Complete the mesing links

- L. The sugar to DNA is
- 2. Cellulose is a linear polymer of
- 8. Amylopectin is a polymer of
- 4. The acidic character of glyoma is due to group
- 5. Definency of causes scurvy
- 5. A chemical or physical change that alters the sequence of bases in DNA molecule is called
- 7. Heart attacks can be checked by using the enzyme
- 5. The chemical name of vicamin B₁₀ is
- 9. The base is found only in the nocleotides of RNA.
- The two strands of the double helix of DNA are held together at definite distances through
- 11. Most of the naturally occurring have D-configuration while most of the naturally occurring have L-configuration.

- Starch as hydrolysed by enzyme to maltone
- 18. In RNA, the sugar is Harrison and in DNA, the sugar is
- 14. Denoturation involves conversion of proteins to
- 15. The molecule in which one of the nitrogen bases is bonded with a sugar molecule is called

Choose the correct alternative

- Glucose and fractore form consolidifferent osasune.
- DNA/RNA controls the transmission of hereditary effects.
- 3. The chemical name of vitamin B, is estaffavial cymnocohplanny a
- 4. The disease symphthelium is caused by deficiency of intermin Dimitorius A.
- Lescanetaspartic and in essential amino arid.

- The audic character of glycine is due to COO group. NH,* group
- Pairing of thymine with adenine occurs through three! two hydrogen bouds.
- Thymine is present only in RNA/DNA
- 9. Guanane is a parine/pyramidiae
- 10. The conversion of sucrose to glucose and fructose is carried out by amylaximusclass enzyme.
- 11. Denoturation alters I does not after manary structure of orutema
- 18. Cottagen is a fibrous, globulur protein.
- At isoelectric point the amino acide have legal/maximum. colubility in water
- 14, α-D-glucose and β-D-glucose are αποιμετωερισμετα.
- 16. Amylopeotra is water solublelinsoluble fraction





MEMORY TEST



"Cay True or Pales

- True
- 2. Faine
- S. True
- 4. True
- 8. False. Uracil is present in RNA and not in DNA.
- False. Lactose on hydrolysis gives glucose and galactose.
- Trace
- 9. True
- 10. True
- False, RNA governs the synthesis of proteins.
- False. Glucose forms two isomeric methylghycomder, methyl α-D-glucoside and methyl β-D-glucoside.
- 13. True. Because they contain equal number of animo and earboxyl groups.
- 14. True
- 15. True.

Complete the missing links B.

- decarymbose
- 5. m.D-glucose
- vitamin 0
- etreptokansses
- precil
- sugars, emmo acida 11.
- ribose, 2-deoxyribose
- 15. nucleoside

- β-D-glucose
- 4. NH.
- 5. mutetion
- 8. cynnocobriamin
- hydrogen bonding
- 12 anylese
- 14 globuler febrous

C_{i} Chasse the correct alternative

- same
- riboflevia
- leucina Б.
- three
- purine
- does out alter 11,
- 18. lenst

- DNA
- 4. vitamin A
- 6. NH, t group
- 8. DNA
- 10. invertage
- 12. fibrous
- anomera
- 16. maoluble

Higher Order Thinking Skills



QUESTIONS WITH ANSWERS

Q.1. Glucose and fructose give the same canzons. Explain.

Ans. The canzing formation involves the reaction at \mathbb{C}_{+} and the carbon while the rest of the molecule remains intact. Since gincose and fructose differ from each other only in the arrangement of atoms $C_{\scriptscriptstyle 0}$ and $C_{\scriptscriptstyle 0}$, therefore, they give the same conzone as बोधका

CEC снон

Glucose

SC, H, NHNH, CaHaNIL

CHOIL N)i, 2H,0 CH,OH

CH=NNHC, H,

 $C = NNHC_aH_a$

CHOPA.

€М₄ОН Clurosazone

Q.3. What forces are responsible for the stability of

a-helix. Why is it also known as 8.6, a helix?

Ans. The stability of 0-belix structure is due to intramolerous bydrogen bonding activeen. NH and -CO— groups of the polypeptide chain. The ti-belix is also known as 3.d₁₃ because each turn of 0-belix contains approximately 9.8 amino acide and a 18-membered ring is formed by hydrogen bonding.

Q.3. Almane has the structure NH₂ — CR — COOH.

ĆH,

Write the structure at pH = 2 and pH = 10.

Ans. Alsume exists as a Zwitter ion in squacus solution as

$$NH_0 = CH = COO$$
. In presence of and (pH = 2), the basic $CH_0 = CH_0$

COO group accepts a proton and it exists as I

NH CH COO:
$$\xrightarrow{H^*}$$
 'H₀N $\overset{\circ}{\mathbb{Q}}$ COU.

In bease mechanic, pH = 10), the scalic group $-NH_3^+$ gives a proton to the bare and it exists as H

$$CH^{1}$$
 CH COO , $\frac{1}{2R} \rightarrow NH^{2}$ CH COC

Q.4. Glucose shows mutarotation when it dissolves in water. The specific rotation of o D glucose and p.D. glucose is +113.2° and +18.7° respectively. Calculate the percentage of two anomers present at equilibrium mixture with a specific rotation of +52.6°

Ans. Let percentage of c-D glucuse present at equilibrium -r
If the amount of open-chain form present at equilibrium is
assumed to be negligible, then

percentage of β -D-glucoses present at equalibrium = 100 -x

$$\times 1.2.2 + 100 \times \times 6. = 52.0$$

 $100 + 100$
 $112.2x + 1870 + 18.7x = 52.0$
 $93.5x = 3.800$
 $x = 36.3\%$
 96 of α -D-gluoose = 96.8%

96 of β-Lightcuse = ±00 963 = d3 7%

Q.5. The Chargoff's rule says that DNA contains equal amounts of guanine and cytosine and also equimolar amounts of adenirs and thymine as:

G = C and A = T(a) Does Chargoff's rate imply that equal amounts of guaranze and adenine are present in DNA?

(b) Does Chargoff's rule imply that the sum of purine residues equals the sum of pyrimidine residues i.e. does A + G = C + T?

(c Does Chargoff's rule apply only to double stranded DNA or would it apply to each individual strand if the double helical strand were separated into two complementary strands?

Ans. (a) No. it does not imply that G=A (b) Yes, it implies that A+G=C+T

(c) This rule applies only to double stranded DNA

Q.6. Explain On electroly six in acidic colution, glycine migrates towards ca hode while in alkaline solution, it migrates towards asode.

Ans. Giyone axists as Zwitter ion, *NH₂—CH₂ -COO In scidic solution, it exists as ostions. I), which migrate cowards

cathode on alectrolysis

(magrates towards cathode

In alkaline solution, glycine exists as anima: II -and therefore, on electrolysis these migrate towards anode

ningrase sowards anode

Q 7 Glucose forms un oxume but glucose pentancetate does not. Explain.

Ann. Glucose reacts with NH_2OH via open chain form which has free -C = O group and forms raime. On the otherhand,

H

glurose pentancetate cannot be converted to open chain form because σ anomeror hydroxyl group σ . OH is acetylated and therefore, cannot form onime

'=Q.8. The K_u and K_b values of c-amino neids are very law, Explain.

Ans. The K_s and K_s values of ct-arount acids are very low because in ct-arount eachs, the scale group is "NH_s" and not usual "COOH group as in carboxylic acids and basic group is "N" natural of NH_s group in all photocontinuous For example, the K_s and K_s values of givene are

$$K_{\rm a}=1.6\times 10^{-10}$$
 and $K_{\rm a}=2.4\times 10^{-17}$

Q.0. Give one example each of transition and which is nebiral and transition and baving more than one chiral center.

Ans. Achirel Glycine *NH₃CH₂COO* Thiral Isolausine, CH₃CE₂CH CHCOO*

Q.40. What is the smallest aldose which can form a cyclic beminestal? Which functional groups are involved to its formation?

Ans. The smallest address is a tetrose which has four C atoms and an O to form a five membered rung

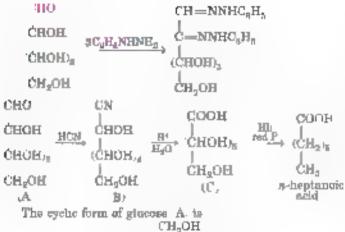
The -CHO and primary -OH groups are incorporated in the ring.

Q.11 Do the anomers of tt-D-glurose have specific rotations of the same magnitude but opposite signs?

Ans. No, only enanhomers have this characteristic property and anomers are not enanhomers

Q,12. A compound $A\in C_gH_{12}O_g)$ is excluded by brownine water into munobasic solid. It also reduces Tollen's reagent and reacts with HCN to give a compound. B) which on hydrolysis gives a compound (C). On treating C with HI/red P_1 s-heptanoic acid is obtained. Compound A on treatment with excess phenyl hydrazine gave D-glucosazone. Name the compound A and draw its cyclic form.

Ans. The compound, A. gives Tollen's respent and is oxidised to monobasic acid with brownie water. It gives D-glucceazune with excess phenyl hydrazine. It must be gluccea as

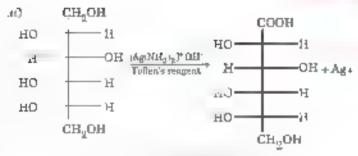


Q.18. The Fischer projection of D-glucose is

th Write Fischer projection for L-glacuss.

(ii) Give the product of reaction of L-glucose with ToBen's rangent.

Axes. (a) The Fischer projection of L-glucose is marror image of D-glucose.



L-Gracenic acid

Q.14. Predict towards which electrode would on coaming acid migrate in an electric field at a

Ann. At most extric point, pI = pH, there is no net charge on α -amino scalend it does not integrate under electric field.

- . Below the pl (pH \sim pl $_{\circ}$ the cation B predommetes and therefore, it angresses towards as thode.
- μ . Above the pl. pH>pD, the amon C predominates and therefore, it magnites towards anode.
 - μ_H As pH = pI there is no set charge and it does not migrate

Q.15. If one of the strands of DNA has the following sequence of bases running in the 5'-8' direction :

- What is the sequence of bases in the complementary strand?
- (ii) Which base is closest to the 5'—end in the complementary strand.

Ans. / Sequence of bases in complementary strand

Gunnine

Revision Exercises

Very Short Resuser Questions

corrying a mark

- What is muterotetion? JHP S.B 2005 Ph.S.B. 2017.
- What is the basic difference between proteins and polypeptides?
- 3. What type of bonding occurs in a-helix configuration ?
- d. Name the enzyme which is used to cure the heart disease.
- Name the anzyme whose deficiency causes albinion and phenylketons area
- 6. What do we get when starch is hydrolysed?

- 7 Name the vitamin whose deficiency causes 1, night blindness and it poor congulation of blood
- 8. What do you understand by glycosidic linkage"

HP 8.B. 2016)

- 9. What is peptide ankage?
- HP S.B. 2016:
- 10. Why is callulose not digestible in human beings?

Hr S B. 2000

- Which auger molecule is present in DNA molecule 7. Ph.S.B. 2013
- 12. Which sugar molecule is present in RNA molecule 7 Ph.S.R. 2019
- 13. Write the channel name of vitamin B_{vv}

Misoram S.B. 2012

- 14. What is the chemical name of vitamin C and which disease Ph. S.B. 2018, 2016 is caused by its deficiency?
- 15. What is the chemical name of vitamin B. and which disease is caused by its deficiency? Pb S.B 20161
- 16. What is the chemical name of vitamin A and which dissase is caused by its deficiency? Ph. S.B. 2013, 2016
- 17. What is the band difference between starth and cellulose? Pb. S.B. 2016
- 18. Name the enzyme which converts glucose into alcohols Pb. S.B. 2014 and H.P.S.B 2015)
- 19. Name the engame which converts starch into maltose? Ph 8.B. 2014
- 20. What is the difference between nucleoside and aucleotade? Pb. S.B 30.6 2017)
- 21. Which of the two components of starch in water soluble? D.S.B. 2014
- 23. Which component of starch is a branched polymer of Eglocose and insoluble in water? (D 8.B. 2014)
- Assem S.B. 2017) 28. Name two bases present in DNA.
- 2d . Which a-amon acid is not optically active?

Meghalaya S B. 2018

25. Definishing of which vitamin causes the discous 'Rickets'? Karnataka S.B. 2018

CBSE QUESTIONS

- . A.J S.B. 2008 25. What is meant by reducing sugar?
- What are monosaccharidas 7(A.I.S.B. 2010, Ph.S.B. 2017)
- 28. Write the structure of the product obtained when glucuse a cardised with ratric ocid. A.I.S.B. 2012;
- 20. Write a reaction which shows that all the carbon atoms m glacose are linked in a straight chem. (A.I.S.B. 2012).
- Write the name of ankage joining two amino scids.

A. S.B. 2013

What are the products of hydrolysis of factors?

A.18.B. 2014

- 22. What are the products of hydrolysis of sucrose? A.I.S.B. 2014, D.S.B.2014
- 33. What are the products of hydrolysis of maitose?

A. B.B. 3014

Mt'Us, from State Boards' Examinations

- 34. The unkage which holds various reupe and units in primary structure of proteins is
 - (a glycomite linkage (b) hydrogen buod
 - #) peptide linkage

(a) mour broad

Meghalaya S.R. 2013

- S5. Vitemin A is called
 - sa Ascorbic and
- (6) Rentingle
- e injectiere)
- d Toroferol Hr. S.B. 2014
- 30. The definency of vitamin B. causes which disease?
 - (a), Bert-Bear.
- (b) Ricketa
- (c) Annemia
- (d) Xarosin
- (Hr. S.R. 2014)
- Definency of vitamin C canass
 - (a) Schryy
- (b) Rhoketa
- (с) Аппенца
- (a) None of these
 - Hr S.B. 2014
- 88. An example of non-recoring anger is
 - ял, Бистовь e) Maltane
- Lactuse (d) None
- 20. Which of the following is not an essential amino actd?
 - (a) Giveine-

c) Phenyl alamae /

- (b) Lysins di Valine
- Hr S.B. 2014
- 40. Which of following is water soluble vitamin?
 - to Vitamin E'
- (b) Vitamin K
- c) Vitemm B'
- d) Viteaim A
- Hr. S.B. 2014. Micorum S.B. 2017 Kernle S.B. 2018:
- J1 Vitemin B, 18
 - sa Ribullavio.
- (b) Cobellemon
- "Thanmane
- d Pyridoxine J & S B 2018
- 42 Which is awestest of the following-
 - (a Sucrose
- (b Glucose
- c Fructose
- .а Мњиче JK S.B 2015
- 43. Rickets may be caused by the deficiency of which vitamin?
 - (d) Vitamin D
- (b) Vitamin C
- (e) Vitamin A
- d) Vitamin B Hr S.B. 2018)

Meghaloya, S.B. 2018

Nagatand S.B 20161

- 44. The function of enzymes in the living system is to
 - (a) Maintam pH
- (b) Catalyse brochemical process
- c) provide automaty
- (d) transport oxygen.
- 45. The disoccharide present in milk is
 - (a) sucrose
- (b) maltosa
- fet lactore
- (a) cellulose

- 46. Which bear is present in RNA but not in DNA?
 - (a) Uracil
- (b) Cytosios
- .c) Guanina
- .d) Thymine
- Meghaloya S.B. 2017 Hr S.B. 2018:
- La aqueros solutira, en amuso sed existe as
 - sav enhan
- (6) anion
- (c) discoon.
- (d) gwitter inn
- Megharaya S.B 2017)
- 48. Which of the following is stored in liver of animals?
 - a Amylose
- (b) Cellulose
- Amytimechin
- d Hyengen Hr S B. 2017
- 49. Which of the following is a polysaccharide?
 - e) Maltons
- .5) Sucrose
- (c) Fractose
- (d) Cellulose (Kernia S.B. 2017)

- The Vitamin responsible for the congulation of blood is
 - (c. Vitamon B.
- (b) Vitamia D
- te Voaman K.
- (d) Vuenun C

Hr S.B. 2018)

- 51. Which one is the complimentary base of adenuas in one strand to that in the other strand of DNA ?
 - .c Cytomne
- (b) Guanena
- e 1 ram
- d Thymne

Margan S.B. 2018)

- 53. Ribose is n.
 - g moopaacchands
- a) polysacchande
- .c polypeptide
- d disarchande

Nagalanti S.R. 9018)

- 53. In which of the following order base, phosphate and sugar are arranged in the nucleotide of DNA?

 - (z. Base-phrephate-sugar by Base-sugar-phrephate
 - (c Phosphate-base-sugar (d) Sugar-base-phosphate

West Benutul S.R. 9018)

>> Street Breweir Questions

rarrying 2 or 3 marks



- What are monosaccharides? Draw open chain structure of aldopentose and aidobeyose. How many asymmetric carbons are present in each ?
- fl. What are reducing and mon-reducing sugars? What is the structural features characterizing reducing sugars?
- 3. Distinguish between
 - (i) a globular protein and fibrous protein

Olagoland S.B. 2015, H.P.S.B. 2015, Kerota S.B. 2018.

- ii) 0-glucose and β-glucose
- (Hr S.B 2018.
- (a) primary and secondary structure of protein.
- July DNA and RNA (Nageland S.B. 2018, H.P.S.B. 2015.
- (v) Nucleosade and nucleotade
- CPb S.H. 2015
- 4. s. Explain zwitter on with example
 - b) Write the chemical name of vitamin 0 and name the disease caused by the deficiency of vitamin C

HPSR 2017)

- What type of forces are respondily for the formation of
 - a) Cross linking of polypeptide chains
 - b) n-helix formation.
 - β-sheet structure.
- What are enzymes? How do enzymes differ from ordinary. chemical catalysts? Comment on the specificity of enzyme. action. What is the most important reason for their вресибенту ?
- 7. Name two components of starch. How do they differ from each other structurally 7 ,C B.S.E. Bample paper 2007
- B. a) What are essential amino acids 9
 - (b) A surfully denote $(C_{i,j}H_{bi}O_{i,j})$ as boiled with $dB_iH_iSO_i$ as alcoholic solution to form two hexoess with the same chemical formula. Identify the carbohydrate and the two heroses. Give necessary chemical equations.
 - c) What is denaturation of protein ? Assum S.R. 2018.
- 9. s. What are vitamins? Name any two vitamins.
 - b) Why vitamin A and C are essential to us? Name one unportant source of each. Hr S.R. R017

- a Last the unportant structural and functional differences oetween DNA and RNA. H.P. S.B. 9016, Pb. S.B. 9018)
 - Draw the structure of 8-D-mitose and 8-D-2-deoxymbose H- S.B. 2011
- a. What are essential and non-essential amino soids?
 - Give chemica, name of valours-A.
 - Name the enzyme which converts glucose into ethanol. H.P.S.B. 20181
- 11. a What is assentially the difference between a-form of glucose and β-form of glucose? What is meant by pyranose structure of gluesse ? (Hr S.B. 2018)
 - Describe what you understand by primary and secondary structure of proteins. (D.S.B. 2011
- What is mean, by if a poptide linkage is a glycosidic 18. 0 inkage ?
 - b Name the bases present in RNA. Which one of these. 8 that present on DNA?
- 14. a Write two differences between starch and cellulose
 - Write one function and two sources of vitemin D Pb.S B 2013.
- a Name the meta, present in Vitamin-B₁₀
 - b) What is Zwicter on?
 - Name the metal present in green leaves.

TH P.S.B. 2018)

- 16. Define the following terms
 - a) Anomers
 - 60 Peptide bond
 - Reducing augur

(Hr.S.B. 2018)

- 17 .a) What is densitieration of proteins?
 - What type of bonds hold a DNA double helix together?
 - Which suggme is present in salive ? What is its Phortaou^{ry} THPSB 201
- 18. .a What is meant by
 - (a) peptide linkage is historialyate? (D.S.B. 2012)
 - b Write any two reactions of glucose which cannot be explained by the open chain structure of glucose DSB 2013 ambeomle
- a What are globular and fibrous protema? Gave examples.
 - What is giyeserdic ankage? Name the disease caused by the deficiency of vitamin D. Give one function of Vicanium D Nagaland S.B. 90.48)
- 20. (i) Write the reaction of glucose with HI
 - What is glycogen? Why is it called animal starch?
 - mi) Name the vitemm responsible for the congulation of blood Meghataya S.B 2013
- 21. .0 Write Haworth structure of "Lactose"
 - (i) What are non-essential amino scids? a) Write Zwider ion structure of "giveine"
 - Name the maragenous base present in RNA but not m DNA Karnataka S.B. 2018
- Name one fibrous protein and one globular protein
 - 8 What are the products obtained on hydrolysis of
 - What is the structural feature characterising reducing Виделе⁷ Megharava S.B. 2018)

- (a) Give one example each of disaccheride and a polysoccharide
 - b What are three types of RNA malecules which perform different functions? (D.S.B. 2015)
- 24. (a) () Name the water insoluble component of starch.
 - is. Mentum one water soluble vitamin
 - (att) In Lysine an essential or nou-essential amino acid?
 - 5 Write the structure of multose. (Karnataka S.B. 2014)
- 26. Biomoleculas are formed by certain specific ankages between simple manuscric units. Write the names of ankages and namoment ands in the following class of homolecules.
 - c) Starch
 - or Protein
 - scine Nucleic acad Maghalaya S.B. 2014
- 46. (i Deficiency of which vitamin causes rickels?
 - Give an example for each of fibrone protein and globular protein
 - 3.44 Write the product formed on reaction of D-gluense with Br₀ water (D.S.B. 2014)
- 37. (c. Explain primary and secondary structure of proteins
 - (b) Differenuate between RNA and DNA.
- Discuss in brief the primary, secondary and tertiary structure of proteins. (Million S.B. 2015)
- 29. (o. What is glycosidic ankage?
 - (b) What are nucleic acids? Mention their two important biological functions.

Write the full form of DNA and RNA. Name the specific

nutrogenous bases present to DNA and RNA.

Meghalaya S.B. 2015.

- 80. (c. What is denoteration of proteins?
 - (b. What are carbohydrates? How are they closufied?
 - c Why are vitamina A and C are essential in us? sive their sources (J.K. S.R. 2015)
- 31 (g. What are switter ions?
 - (b) What is densitiration of proteins?
 - to. What is eleant by inversion of sugar?
 - (d) What is materioteticm? (HP S.B. 2015)
- 82. What happens when glucose reacts with the following
 /a. HI hest
 - b NH,OH
 - c Br. water / Hr S.B. 2018)
- 38. (i. Which one the following is a dissectioned: Storch, Maltone, Fructone, Glucose?
 - (4) What is the difference between fibrous protein and globular protein?
 - vm Write the name of titamin whose deficiency causes have deform use in chadren P.S.B. 2015.
- 84. ,i) Whaters earbohydrates? Give the unportant functions of carbohydrates
 - (ii) What is difference between α-glucose and β-glucose? Write their cyclic atmosphes. IHP S R 90 S.
- 86. What is meant by denaturation of protein? Differentiate between fibrous proteins and globular proteins
 Or

Name the three major classes of carbohydrates and give he distinctive characteristic of each class. Hr S.B. 2018.

- 36. Explain the following terms in relation to proteins:
 - Peptide inkage (Hr S.B. 2016, Trapura S.B. 2016)
 - a) Denaturation (Hr S.B. 2016)

- as Primary structure Tropico 8.B 2016
- 37. (z What is polysaccharide? Explain with an example
 - b. What is meant by primary structure of proteins? Korkete S.B. 2016:

 What are neutral, and is and basic amon and Which vitamin deficiency lead to scurvy? Mention one function of vicana C

9r

What are reducing and non-reducing sugars? What is the sequence of bases on niRNA molecule that can be synthesized in the following strand of DNA-GATCATGGC? (Nagatord 5.B 2016)

- 89. Diatinguish between the following
 - A globular protein and a fibrous protein.
 - (ii) Primary and secondary structure of proteins.

Meghalaya S.B. 2018)

- 40. (c. (i) What is Zwitter 2017
 - (i) Name a source of vitamin E
 - (ii) Name the disease caused due to deficiency of lemmin K in our body

Or.

- b. (1) What are enzymes?
 - What kind of linkages hold together manuscers of DNA?
 - (iii What is denaturation of protein?

Assem & B 2070-

- 41. 6 Write the name of two monoenerhandes obtained on hydrolysis of actose sugar
 - (6) Why Vitamin Commot be stored in our body?
 - What is the difference between a nucleoside and nucleotide? (D.S.B 2016)
- 42. c Explain the terms.
 - () Zwitter son. ... Oligosaccharides
 - Or
 - (b) What are the different types of RNA found in the cells of an organism? State the functions of each type. (Nagaland S B. 2017)
- 48. What is denaturation of proteins? Mention four different types of forces that stabilize protein structure. Microm S.B. 2017.
- 44. Define the terms:
 - to Bromolecules (in Carbobydrates
 - (m) Reducing Sugars. (Hr. S.E. 2017)
- 45. .a. Fresh tumetoes are a better source of vitamin C than those which have been stored for some time. Why?
 - (b) Represent sucrose and rs-D- maltose in the form of Haworth structures (Manapur S.B 2017)
- 46. Explain the amphoteric behaviour of amino acids
- Kerola S.B. 2017: 47 a: What are non-easential ainmo ands? Give one example
 - (b) Name one vitamin which is not soluble in water and fat
 - fc. What is the chemical basis of baredity?

Assam S.B. 2017

- 48. a. What are reducing sugare?
 - (b) What is the effect of desirturation on the structure of proteins?
 - (c) Why cannot vitamin C be stored in our body?
 - (Meghalaya S.B. 2017)
- 49. What are monoacchandes 7 Give the reaction of glucose with acetic anhydride and hydroxyl amine
 - Jamma S.B. 2018,

>>>

- CBSE QUESTIONS -----



- 51. (a) Answer the following questions briefly
 - (i) What are two good sources of vitamin A?
 - (2) What are nucleotides ?
 - ...) Give an example of a simple apid.
 - b How are carbabydrates classified 7 A.I.S.B. 2007.
- 52. (a) Answer the following questions briefly
 - .. What are reducing augura?
 - ii) What is meant by denoturation of a protein?
 - an) How is oxygen replenished in our atmosphere?
 - b' Define enzyme-

A.I.S.B 20071

58. What happens when D-gluroce is treated with the following reagents 7

Hī.

- (ii) Bromme water
- (as) HNO,

(A.I.S.B. R008)

- 54. How are vitamins classified? Mention the chief sources of vitamins A and C, (A.I.S.R. 2008)
- 55. c Name two water soluble vitamine, their sources and the diseases caused by their deficiency in die.

DSB 9009

- (b) Name the four bases present in DNA. Which one of these is out present in RNA? (ALS.B. 9000)
- Name two fataniable vitamins, discrisources and die diseases enused due to their deficiency A.I.S.B. 2009.
- 57. Name the four bases present in DNA. Which one of these is not present in RNA?
 A.I.S.B. 2010*
- 38. (c) What is meant by

peoplide ankage in pyranous structure of glacoses.

- b' Write the main structure, differences between DNA and RNA. Of the four bases present, name those which are common to both DNA and RNA. A.I.S.R. Eff.I.I.
- 69. What is essentially the difference between diglarase and β-glucose? What is meant by pyranase structure of glucose? A.I.S.B. 2012
- 60. Define the following terms as related to proteins
 - r) Peptide ankage
 - (ii) Primary structure
 - (41) Densituration (A.I.S.A. 2008, 2014, D.S.B 2014.
- 61. Define the following recus-
 - () Glymardiz ankage
 - it Invertauger
 - m) Obgosaechandes

AISB. 2015

- 62. Define the following carms:
 - Nucleobde.
 - ee Amouners
 - ttt Essentiai annon acida /

A.15B. 2015

68. 6. Which one of the following is a polyscocharide

Starris, Maltose, Fructose, Glumee

- 'ii/ What is the inflerence between manye protein and denstared protein?
- (d) Write the name of the vitamin responsible for the congulation of blood-(A.I.S.B. 2015.
- 64. (i) Write one reaction of D-glazose which cannot be explained by its open sham structure.

- fig. What type of knikings is present in nucleic code?
- (i.i., Give one example each for water-entable vitamins and fat-eal this vitamins A . 5 B. 2010)
- 63. (a, Write the product when D-glucuse reacts with cour. HNO,
 - 6. Anumo seeds show aniphoteric behaviour. Why?
 - fc. Write one difference between α-helix and β-pleated structures of protecois A.I.S.B 20182
- 06. Define the following with an example of each
 - ia, Polysaccharadea
 - ib. Denotored protein
 - ic/ Essential amino acids

(A.I.S.B. 2018)

Long Anomor 🕸

careging 5 marks



- to State the constitutions, differences between DNA and RNA. Write down the names of the bases produced as aydrodyna of DNA.
 - 5) Draw simple Fischer projections of D-glucose and Legiticose. Can libere be inhelied enantumers?

D.S.B. 2008

- You Write reactions to above how glucose separately reacts with
 - / NHOH
 - 4 HNG
 - ttis cammontaeni AgNO,
 - b) What do you understand by
 - (c) denaturation and
 - . renaturation of proteins?
 - c) Name the deficiency discuses resulting from lack of vitamus A and E in the diet D.S.B 2005)
- (a Name the three mojor classes of various/drates and give an axample of each of these classes
 - b Answer the following
 - What type of linkage is responsible for the primary structure of proteins?
 - Name the location where protein synthesis occurs in our body
 - c) Explain the following terms
 - (c) Mutarotation
 - u Avitammosus

(D.S.B. 2007

>> -

-CBSE QUESTIONS



- 4. (a Answer the following questions briefly
 - (i) What are reducing sugare?
 - بن) What is meant by densturation of a protein?
 - asi. How is oxygen replemehed to our atmosphere?
 - Define enzymes

Page

- to Answer the following questions briefly
 - (a) What are two good sources of vitanun A?
 - a.) What are audiconden?
 - (141) Give an example of simple lipids.
- 5) How are carbohydrates classified? (A.I.S.B. 2007)

Hints & Answers

for Revision Exercises

Very Short Inswer Questions

- Hydrogen banding between NH and —0=0 groups of peptide bonds.
- 4. Streptokranse
- 5. tyrosusase, phenytatanine bydroxylaae
- 7 Valamin A Valamin R
- 11. Deoxymbose
- 19. Ribose
- 13. Cvanocobatamine
- 14. Accorbig acid scurvy
- 16. Thisming, ben-ben
- 16. Retanor aught blandness
- 18. Зущена

- 21. Amytose
- 22. Amytopectur
- 23. Adennie Guanne
- 24. Glympe.
- Vosman D.
- 28, Sambann and
- 30. Peptide ankage
- 21 Mayras and galactrise
- 89. Humae and fructuse
- 28. Marriage
- 64. c 35. b 36. a 67 a 38. a 39. a
- 40, c) 41, (c. 42, c) 48, a) 44, b 45, c
- 48. a 47 4 48. d 49. d 50. c 51. d
- 69. a. 48. (b)

Competition File

Additional useful information and Objective Questions

ADDITIONAL USEFUL INFORMATION

▶ LIPIDS

These armody, fatty or waity substances present a ring organisms. They constitute those structural components of plants and tisenes that are soluble or organic solubits such as charoform other etc. and are span agry soluble in water. Their main fluwhouse are to form part of the structure of biological membranes and to store energy for the cell.

Chemically, lepids are exters of long chain fatty acids and alcohols. They can be divided into three mein classes.

Simple pids which constitute long them fatty sends and their and derivatives

- Compound "gods which give fatty ands, archoss and other compounds on hydrogens
- .ni) Derived upids

Simple lipids. One and fots are simple lipids. These are most abundant lipids. These are esters of glycorol and three fatty ands. These are also called triglycorouse. The surve fatty ands may be identical or different. The naturally occurring fatty ands may be esturated or measurated. For example,

Baturated fatty acids

Lourie acid + CH₂(CH₁₎₂COOH Myristic acid + CH₂(CH_{2/12}COOH Pulmitic acid CH₂(CH_{1/12}COOH Steams acid CH₂(CH_{1/12}COOH

Unsaturated fatty notice contain one or more double bunns;

Claim and $\Phi_{\pi}H_{\pi p} \cong \Theta H$ Linearing and $E_{\pi}H_{\pi p} \cong \Theta H$

 $CH_{g^{\prime}}CH_{g^{\prime\prime}}CH=CH_{h}CH_{g^{\prime\prime}}COOH \qquad CH_{g^{\prime\prime}}CH_{g^{\prime\prime}}CH=CHCH_{g}CH=CH_{h}CH_{g^{\prime\prime}}COOH$

One double bonds

Linatense acid C, H, COOH

 $CH_{\bullet}CH_{\bullet}CH = CHCH_{\bullet}CH = CH(CH_{\bullet})_{\bullet}COOH$

"Three double boads

Our and face being glyceryl esters of fatty acids are also called triglycerides. The communication examples of glycerides are

The glycendes containing large proportion of saturated acids are solids as room, compensuite, and are called fate. On the other hand, he glycendes containing large proportion of unsaturated unds are inquide a containing large proportion of unsaturated unds are inquide a containing large proportion of unsaturated unds are inquide a containing large proportion.

They undergo hydrolysis to give one molecule of glyrerol and three molecules of fasty ands per molecule of ou or fas-

To light your little that are these

Triggscendes are very amportant and find uses in scape prime variables, printing ink outments and creams

Faity acids are major sources of energy of the cell. Certain faity scrits like knotes; end and knotene acid help the body to synthesise a very important group of compounds called prostuglunds. These control almost all physiological activities of the body

Women are nice estern and they are simply up in They are fatty and estern of long chair monohydric alcohols and may be represented by the general forms in RD * 2R' where R and R' are long hydrocarbon chains. For example,

In fact, they occur as mostures. The worse are would agreed at nature and play an important role as a protocove contains on fruits, neaves and commute. They have the properties of water assumbanty, flexibility and com-reactivity and, therefore, they are an excellent contains.

Dees: Waxes are used

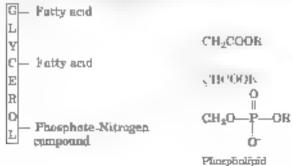
45 in cosmetics, cintments, and as polishes for floors, furniture ste-

'a. as thin contings on fruits weres, skin and protect the surface from loss of water and attack of nucro-organisms.

'ru in making randles

Compound lipids. The compound tipids on hydrolysis give other substances in addition to aerahols and fatty edids. Phospholipids are examples of compound lipids.

Phospholipeds are nowed governdes of higher fatty acids, and phosphores acid in which two l M groups of glycerol are estembed by fatty acids and third by some demonstrates of phosphores acid.



The common examples of principlumpids are lecithing and cophagins which are found principally in the areas, nerve cells and over of animals. These are also found to ogg yelks, yearst soyabsens and other foods

Lecithina are derivatives of chaline chloride, HOCH, CH, NCH, & Cl

Cephanine are derivatives of ethanolamma, HOCH_CH_NH_

CH₂COOC₁₂H₂₁

CH_BCOOC_{UE}H_{B3}

сисоос ина

CHCOOC_{IS}H_O,

 $\Gamma\Pi_{9}O_{7}(4)=OC\Pi_{9}C\Pi_{9}N^{*}(C\Pi_{9})_{3}$

CH₄ O P CH₃CH₁NH₃

Ü' Locishin

Thus reciting contains a quaternary N whereas cephalia contains only primary N

The phosphotipide are good neutra, surfactants. They have excellent am suffring and membrane forming properties. In mayonnaise, he phosphoglyperides of egg yolk keep the of emulsified or the consistent.

Derived lipids. Storoids like cholesterol, fat soluble vitamine like vitamine A. P. E and K are the examples of derived upids. CELLULAR MEMBRANES

Collidar membranes are constituted manny of phospholigids and chotines. Their relative proportions vary in different cells. The itrospholicides are acranged in a doubte layer binayer with their hydropholic molecular firsty and choins that one the memorial be membrane. This bileyer arrangement allows the polar need groups purephote ester to interact with aqueous surroundings into made and outside the cell and non-pinar tails to be away from the aqueous medium. The protein components in the memorane are either embedded at the orlayer or attached to the other side of the membrane depending upon their functions.

The membranes have many specific functions in leving organisms. Some of these are

- They members the chape of the col
- o They control the consider movements by selectively beering out certain compounds and transporting others.
- (att) They keep the cell contents in place.
 - or They allow cell to cell recognition and contain receptore for many hormones.
 - a) They protect the cell from mjury

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions

A TOPICE SE MULTIPLE CHOICE QUESTIONS with only one correct answer

Carbohydrates

Select the Correct Answer

- A1. Glucose and fructore are
 - a structure somers b functional isomers
 - al announce (la
 - c) anomera
- (d) geometrical isomera.
- Att. Churren in
 - a) aldopentose
- (b) aldohexons
- c) Ketopealous
- (d) ketnheznes

- A8. The monmon ands of starch are
 - ascert(ga) v.
- δ β-glucose
- r pyranose
- d grinttope
- A4. Which of the following is the sweetest."
 - a Giacose
- b Fruetose
- ic Maltiss
- d Sugge
- A5. Maltone in made up of
 - a) a-Li-glacose
- b D-fructoee
- α-D-glucose and β-D-glucose
- (d) glucase and fractors.
- A6. Invert sugar u a ouzture of
 - (a) glucose and fractors
 - (b) glucose and lectose
 - (c) glucose and lactose
 - d may gluctae

A7 6

A17 b

AB, 0

A16. a

A9, b

A.9. c

 $A_{\alpha}0_{\alpha}$ of

A20. b A21 -

All of

412. d

436.

Ata. or

A.48. c

A.4. 6

A16. c

Adda a

A16. c

A36. 6

Competition File

A7-	Glucose on treatment with notions amplgam gives	A16. Which statement is incorrect about peptide bond?
	a n-haptanoic neid (b) corbital	 a) C-N bond sength in proteins is larger than asimi.
	c) glueome acid (d) gluevere acid	bond length of C-N bond.
As.	_	 5 Spectroscopic analysis shows planar structure of
	hydrazine to yield ocazone. The value of X is	CO-NH group
	a) three (b) two	e. C. N bond length in proteins in smaller than usual
	c) one .d) four	bond sength of C-N bond
A45	Cellulosa is not digestible by human beings due to the	d) None of the above.
P BLANT P	nbeenes of callulose hydrolysing enzyme called	A.S. In basic medium, alamine smale as
	a, areass (a) celulase	(a) CH,CH-NH; (b) CH,CH-NH
	c zymase d averbee	GOOD , W GOOD
AID	α-D(+ glucose and β D(+, glucons are	e CH ₂ CH NH ₃ d CH ₂ CH NH ₃
	a ensultamera (b) geometrical momera	
	e) epimers .d) automers	TOP COLOR
A11.	Complete hydrolyms of cellulose gives	A20. Which of the following is not an essential emino seed?
	a L-glucose (b) D-fructose	a) Lyane / (b) Glyene
	e) D-cibuse .d) D-glucuse	.c Phenyletanine (d) Value
A12.	Which of the following is not true about glucese?	A21. Densturation of protein leads to less of its biological
	a. It is an aidobesose	activity by
	b) On heating with HI it forms p-nexane	(p) loss of primary structure
	_	21 loss of primary and secondary structure
	c) It does not give 2, 4-DNP test	loss of secondary and certary structure
	d' It is present in farances form	of formation of amore needs
Amı	mo and Proteins	A22. In which of the following pair both the proteins are same
		type fibrons or globator?
A18.	The ammo scads are the end products of the digestion of	er myosin sinimiti
	o false (b) lipida	(b) anaulin, collegen
	c proteins (d) enzymes	(c) keratin, filtroin
414	The sequence in which amon ands are arranged in a	d albumin myosin
	protein is called	Enzymes, Vitainins and Harmones
		Description Parameter State Control
	a primary structure (b) secondary structure	A23. The chemical messengers produced at ducuesa glanda are
	e) termany structure .d) tetrahedra, structure	called
AJD.	The bond that determines the accordary structure of	(p) Lipids (b) Cellular membrane
	protein te	(c) Hormones (d) Antibodies
	a Covinlent bond	
	↑ Sulphur ankaga	Alt. The hormone which is secreted in the pancress and
	c Hydrogen bond	controls the metabolism of glucose in the body is
	d) Iome boad.	(a) thyroxina (b) czytoun
A16.	Which of the following is a protein ?	(c) insulm (d) cortuone
	a Nyengen & Amylopechin	A25. Deficiency of vitamin II sends to disease
	c) Keratin di Lectiun.	(c) Runkets (b) Beri-beri
A17	Which among and has no asymmetric carbon main?	c Scurry d Night-blindness
	a Historiae — b Olymne	A26. Night-blundness may be caused by the definiency of vicantin
	.c) O-A.snune .d) Threonin.	.a) A (b) B
		.c' C .d'i D

	Compeci	twn Jux
A27	Vitamin A is called	(c) phosphate more
	a Ascorbic arid b Retanol	.d) hydrogen bouds.
	.c' Chimferol (d) None of these	A40. Metabolic activities of cells are controlled by
A38.	The only vitamin with metal atom in it is	.e) proteins (b) DNA
	a Vilanua A .b, Vitanua K	c) RNA d) fa
	.e) Vitamin B _{in} (d) Vitamin E	A41. Chargotts rule states that in an organism
A29.	Ensymes are regarded as	a) smoont of adequat (A, as equal to that o
	a. biocatalysts b. activators	
	.c) messengers (d' antibodies.	thyrmne (T) and the amount of guarante (G) as equa- to that of cytosine (C)
A30.	Which of the following B-group vitamin can be stored in	Ť
	our body	(b) Account of adecume (A _f is equal to that of guarantees (T) and the potential of there are (T) and the potential of th
	.c. Vitamin B. ,b) Vitamin B.	(G) and the amount of thymone (T) is equal to the of cytomic C
	(c) Vitamin B _a (d) Vitamin B ₁₂	
A21,	Which of the following hormones is an amino and	(c) Amount of adentite As is equal to that of cylosing
	dertvabve ⁷	C) and the commut of thymne (T) is equal to the
	a Oxytoesa .b; Estrone	of guerane (G.
	c) Adrenalme (d) Vasopresam	(d) Amount of all bases are equal
A32.	Most appropriate source of vitamin C is	A42. Which of the following statement is not correct?
	a) careals 6. agg yolk	 (a) Cytosine and thymne are pyrimduses
	.c) citrus fruits (d' milk	b) DNA differs from RNA in sugar as well as introgenous
Nuc	lese nords	puse
		,c In RNA beterocytic amme base to bonded to C-x' o
A30.	Nucleic scide ere polymere of	sugar and the phosphoric and is bonded to C-5 sugar
	.α nucleosides (b) globuhus	position
	.c' nucleons (d) nucleondes	(d) In double behix structure of DNA, thymine can bond
A34.	The three dimensional structure of LNA was elucidated	to rytosine by two bydrogen brade
	by	A40. In a polynucleolide, the bond which joins two nucleotides
	a James Watson .b; M Wilkins	a colled
	e Dricon (d' Franklin	a) glycosidic band (6) ammoester band
ASD.	Which of the following is not present in DNA?	(c) phosphothester band(d) disnlptode linkage
	a) Adenine bi Guanine	A44. Biotin to chemical name of vitamin
	c) Uracil (d) Thymine	a) B ₄ (b) E
A36.	The chemical change in DNA molecule that could lead to	.c) H (d) K
	synthesis of proteins with an allered amino ands sequence	A45. In double believel structure of DNA, the number of hydrogen
	ta cailed	bands involved in thymine and adenue is
	c: Replication b. Lipid formation	4 . 6 8
	.c) Celialar membrana (d) Mutation	0 (b. E (a.
487	In nucleic ocids, the indevidual nucleolides are larked	
	tirough	A40. Which of the following gives maximum energy in metabolic
	 c. bebride mysde p. byosbyte Bronb 	processes ?
	(c) glymaidic linkage (d) hydrogen bonda	a) Proteins (b) Vitamins
A88.	The relation between the nucleutide implets and the annuo	e) Lapade (d) Carbobydrates.
	ncide is called	A47. Phospholipide are esters of glyrerol with
	.α Gena b' Genetic code	.a) three carboxylir acid residues
	c Rentention d' Enzymes	 b) two carboxylic acid residues and one phosphate group
A39.	Mutation in DNA occurs due to changes in the sequence of	 c) nne carboxylic acid residue and two phraphate groups
	g) autorgeneous brees	a) three phosphate groups
	b' ribose unute	

A27 b A28. c A29. a A30. d A51 te A32. te A38. id A34. a A35. te A36. d A37 b A38 b A30. a A40. b A41 a A42. d A43. c A44. c A45. b A46. c A47. b

B (MULT P.F CHOICE QUESTIONS from Competitive Examinations

AIPMT & Other State Boards' Medical Entrance

- B1 Which functional group precipitates in disulphide bond formation in proteins?
 - (a Throester
- (b) Throother
- (c) Thiol
- .d) Thiolartone

A B.S.B. Med. 2005.

- B2. Which of the following is a peptide hormone?
 - a) Testosterone
- (b) Thyroxin
- (c) Adrenaime
- d) Insulia

C.B.S.E Med 2008

- **B2.** The human body does not produce
 - d Vostima
- b hormones
- (c) enzymes
- .d) DNA (C.B.S.E Med. 2006.
- B4. RNA and DNA are chiral unlecales, their chirality is due to
 - a', chural bases
 - b) chiral phosphate ester units
 - (c) D-augur companient
 - (d) L-sugar component

fC B.S.E. Med 2007

- B5. Which one of the following is an amine hormone?
 - a Azymen
- (b) Insulme
- (c) Progesterone
- d) Thyroxine (C.B.S.E. P.M.T. 2008)
- Bo. In DNA, the complementary bases are
 - (d) adecine and thymine guanine and sytuana
 - b) adenine and thymine guanine and uraci-
 - (c) adenine and guenine, thymine and cytosine
 - (d) urand and adenine, cylonine and guinne

CB.SE. PMT 2008.

- B7 Which of the following hormones contains toding?
 - d Teatosterone
- b Adrenaume
- (c) Thyrmme
- ,d) lnauha

CBSEPMT2008

- B8. Which of the following does not exhibit the phenomenon of mutarotation?
 - to the Mailtone / to: 1 Emercise
 - (с) (+ Яшьтова
- d) Lastuce (CRSE PAIT 902)
- BD. Which one of the following statements is not true regarding (+) lactors ?
 - to On hydrolysis (+) lectors gives equal amount of Di+ glucose and Di+ galactuse
 - (b) (+) Lactose is a β-glucoside formed by the union of a molecule of D(+) glucose and a molecule of D(+) galactose

- c +) Lactose is a reducing sugar and does not exhibit materosasion
- .d) +) Lactose, C₁₂H₂₂O₁₁ contains 8-OH groups
 A.PMT 2011
- B.0. Which one of the following does not exhibit the phenomenon of mutarotation?
 - (a) +) Maisone / (b) (> Fructose
 - .c' +) Sucross ____,d') Luctose (AIPMT 2011
- B.1. Which one of the following asts of monoeacchardes forms socrass?
 - σ) α-D-galactopyranosa and α-D-glucopyranosa
 - b) α-D-glucopyranosa and β-D-fructofuranose
 - c) β-D-giuropyrmanse and α-D-fructofuranese
 - d) tt-D-giucopyranose and fl-D-fructopyranose

AIPMT 2012)

- B.2. Definency of vitamin B, causes the disease
 - (a) crarynlarous
- (6) berr-hera
- c) chadosia
- (d) sterikty (AJPMT 2012)
- H.3. Which of the following bormones is produced under the conditions of stress which stimulate glycogenolysis in the liver of human beings?
 - a) Thyroxio
- (9) Inentre
- (c) Adminishing
- of Estandual of MPT 2014
- B.4. Di+refuces reacts with hydroxyl amone and yields an oxime. The structure of the oxime would be

		CH	I-NOH			(T	I = NOH
	Н	·C	OH		но	\mathbb{C}	Н
	НО	$^{\mathrm{c}}$	Н		ΗD	P	H
۵	но	\mathcal{C}	н	ь	Н	\mathcal{C}	OH
	H	C	OH		Н	C	OH
		rΉ	l, H			C)	l, H
		ĽН	I = NOH			C)	I = NOH
	HO	*1	H		H	ϵ	OH
	Н		OH		Ηľ	,	Н
ą.	HO	ξ^{α}	Н	ь	H	47	ЭH
	Н	Ċ	ОН		Н	Ċ	OH

CHLOH

A I P M T 2014

"H_aUH

B1. (c B2, d) B3, d) B4, (c) B5, (d) B6, (e B7, (e) B8, (e) B9, (e) B10, (e B11, (b) B12, (b) B18, (e) B14, (d)

- B16. The correct statement regarding RNA and DNA. respectively is
 - a) the sugar component in RNA is a arabinose and the sugar component to DNA is ribose
 - b) the sugar component in RNA is 2° decryribose and the sugar component in DNA is arabinose
 - (c) the anger companent is RNA is arobiness and the augur component in DNA is 2' deoxyribose
 - (d) the sugar component in RNA is ribose and the sugar component in DNA is 2" decryribose

NEET 2010.

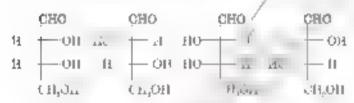
- B16. In a protein molecule various ammo acids are inked together by
 - a) peptide bund
- (b) datave bond
- (c) α-glycosidie bond (d) β-glycosidie bond

NEET 2016.

- B17. Which one given below is a non-reducing augur?
 - a Glurose
- (b) Sucross
- (c) Mattose
- d) Lactone
- (NEET 2018.
- B18. The central dogma of molecular genetics states that the genetic information flows from
 - (a Amino acide + Proteins + DNA
 - (b) LNA + Carbohydrates + Proteins
 - (c) DNA → RNA → Protems
 - (d) DNA + RNA + Carbobydrates

(NEET 2016).

B19. The correct corresponding order of names of four aldones with configuration given below



respectively is

- L-erytaruse, L-threase, L-erythrose D-tareose
- D-threose, D-crythrose, L-threose, L-crythrose
- (c) L-crythrose, L-thronse, D-crythrose, D-thronse
- d' D-erythrose, E-threuze L-erythrose L-threuze NEET 2016.
- B20. Which of the following statements is not correct?
 - a) Ovalbumin is a simple food reserve in egg-white.
 - (b) Blood proteins thrombin and fibrinogen are involved m blood clatting

- c) Denoturation makes the proteins more active
- d) beautin maintains sugar level in the blood of a human body (NEET 2017)
- B21. The difference between analyses and analyspectio is
 - a) smylopectin have 1 + 4 g-inkage and 1 + 6
 - b) nmylose have I 4 0-linkage and 1 8 fi-Junionge
 - c) rmylopeckin have I * 4 0-unkage and I * 6. 6-inknge
 - c) ranylose is made up of glucies and galactose
- B23. If one strand of DNA has the sequence ATGCTTGA, the sequence in the complementary strand would be
 - (a) TCCGAACT
- (b) TACGTAGT
- & TACGAACT
- d) TAGCTAGT
- (c TACGAATC
- (Korala P M T 2008)
- B20. In squeous colution, en ammo seid existe es
 - a) ention
- (6, maga
- 'e. diamon.
- d) zwitter iou
- a) neutra, moiscule (Kerma PMT 2010)
- **B24.** The linkage between the two monosecularide units in
 - (a) C, of β-D-glucose and C_s of β-D-galactose
 - b C, of β D galactone and C, of β D glucose
 - C, of n-D-galactose and C, of β-D-glucose
 - al) C, of β-D-galactriae and C, of α-D-glucose
 - C, of n-D-galactose and C, of n-D-glucose

Kerale PMT 2011

(Kerala PMT 2012)

- B25. A basic amino acid among the following is
 - a) glyeins
- (b) value
- (c) proline
- (d) leucine
- a) bustadine
- B26. Glucose on oxidation with bromine water gives
 - .o) glucome acid
- (b) kurtame neid
- (c) saccharic acid
- d) mesocratic soid
- (e) tartronic and
- (Kerola PMT 2013)
- B27 Cheilone and digestive disorders are due to the deficiency

 - o) votamin A to Musmune
 - c' ribollavio
- d recorbinged
- (e) pymdoxine
- (Korala PMT 2014
- B28. Glucose does not react with
 - (a) Hydroxylamoe
- (b) Cone HNO,
 - e) scetur amhydride
- (d. sodium bisulphite
- Br₂/H₂O.

(Keralo PMT 2015)

JEE Main & Other State Boards' Engineering Entrance

- B39. In both DNA and RNA, between the base and phosphate ester linkeres are at
 - a) C_s' and C_s respectively of the sugar nulecule.
 - b) C_0' and C_0' respectively of the augar molecule
 - (c) C₁ and C₂ respectively of the sugar undecule.
 - d) C_z' and C_z' respectively of the sugar molecule.

A.I.E.E.R. 2005

- B30. The secondary structure of a protein refers to
 - (a) bydropholas interactions
 - (b) sequence of ty-amino code
 - (c) fixed configuration of the polypeptide backbone
 - d' O-hebeni backbons.

(A.I E.E E 2007

- B31. The two functions, groups present in a typical earbobydrate are
 - -OH and -COOH a)
 - -CHC and -COOH
 - (c) >C--O and -OH
 - ch OH and CHO

ALEER 2009.

- B32. Branet fast is not given by
 - a, Urea
- (b) Proteins
- (c) Carbobydrates
- d) Polypeptidea

(A.I.E.E.E. 2010.

- B33. The presence or obscure of hydroxy group on which carbon atom of sugar differentiates RNA and DNA.
 - (a) let
- (b) 2nd
- sel Brd
- .d) 4th

CALEEE 9011

- B34. The change in the optical rotation of freshly prepared solution of glucose is known as
 - (a racemisahon
- (b) specific retation
- mutarotation
- d tautomenam

ATERE 2011

- B35. Which one of the following statements is correct?
 - to All amino acids are optically artists
 - Ail amino acids except glycine are optically active
 - (c) All amino acids except glutamic acid are optically active
 - (d) All amino acida except lysine are optically active A.I E.E.E 2012
- B36. Which of the following compounds uso be detected by Moherble test?

B42, (c)

in Sugars

B40, (c) B41, c

(b) Ammes

B43, 1d

- (c) Primary alcohola .d) Nisro compounds

A.I E.E E 2012

- B37. Synthesis of each molecule of glucose in phytosynthesis
 - (a) 6 molecules of ATP
 - 18 molecutes of ATP
 - c' 10 molecules of ATF

an 8 curlectives of ATP

(JRE Mater 2013)

288. Which one of the following base is not present in DNA?

- endonum (e.
- o advance
- (c) sytosune
- d) libymine

JEE Main 2014

- B59. Which of the vitamins given below is water soluble?
 - c. Vitamin E.
- by Vitamin K
- ter Vitantan C
- de Viennen D

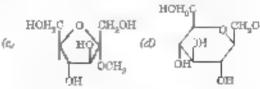
JEE Main 2015:

- B40. Thiel group is present in
 - (it. cytosine
- the cycline
- (c) bysteine
- (d) metaroune

(sEE Main 2016)

B41. Which of the following compounds will behave as a reducing gugar in an aqueous KOH solution?



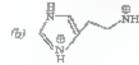


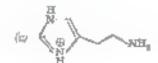
JEE Main 2017)

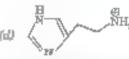
- B42. Glucose on prolonged beating with HI gives
 - /a. n-Hexane
- % . Hexene
- in Hexanoic acid
- (d) 6-10dohezanak

JEE Main 2018.

B48. The predominant form of histamine present in human blood is (pK_, histamine)







JEE Main 2018,

B44. A tripeptide is written as Giyeine-Al anine-Glyeine. The correct structure of the tripeptide is

Kamataka C E T 2008.

- B45. Cellulose is not digestable by human beings due to the absence of a cellulose hydrolysing enzyme called
 - (a) celialese
- (б) хушине
- c) invertage
- d) urease ALCET 20.0.
- B46. Lactore in made of
 - a, o-D-glucose only
 - (b) O-D-glucose and β-D-glucose
 - c α-D-galactose and β-D-glucise
 - d (4-D-galactose and 4-D-glarose
 - β-D-galactree and β-D-glucuse

Aurata PET 2010.

- B47 to-maltone consists of
 - (a) one α-D glucopyranose unit and one β-Dglucopyranose unit with 1-2 glycondic linkage
 - two o-D-glasupyramose mats with 1-2 glycondse unlarge
 - (c) two β-D-glucopyranose traits with 1-4 glycoxide mixece
 - (d) two c-D-glacopyranous units with 1-4 glycosofic unitage

Kornotaka (ET 2011)

- B48. Glucose neacts with ToDen's resgrant to give a derivative of
 - (a monocarboxyfic and ,b dienrhoxylic and
 - c ketone
- al) keto ecid

Orista JEE 2011.

- B49. How many monomercharides are obtained by hydrolysis of sucrose ?
 - a) 1 c 3
- (b) Q
- d 4 Adisha JEE 2012
- Boo. The q- and β-forms of glucose are
 - r isomers of Di+ glacose and L. glucose respectively.
 - b) diastereomers of glucose
 - (c) anomers of glauces
 - .c) somere which differ in the configuration of O-2
 - (e) seemers which differ in the configuration of C-5

Kerata PET 2013,

- B51 Which one of the following forms the constituent of oell well of plant cells ?
 - (a) Starch
- (b) Glycogen
- c) Cellulose 4
- (d) Amylose
- (a) Amylopactus
- 'Kerala P E.T 2012)
- BOS. Sucrose is not a reducing sugar since
 - a) it is chemically stable
 - (b) A contains no free aldehyde or kato group adjacent to a CHOH group
 - (e) it is built up of a fructose anit
 - (d) it is optically school. (Kargataka C E T 2012)
- SAS. The correct structure of the dipeptide gly-dia is



- # D: 155 5010
- B54. Ribose and 2-deoxymbose can be differentiated by at Febburg's reagent b. Tolleric reagent.
 - c) Barfoed's reagent of Osazone formation

W B. JEE 2019)

- B65. Chienes when reduced with HJ and red phosphorus gives
 - (a) a-bexane
- (b) a-heptana
- e a pentance
- of ninchage

(Kernateke CET 2015

B56. How many amino acide are present in insulin?

Competition File

(6) 61 .d) 22 (c) 20 (e) 59 Wernia P.R.T 9013 B57 Which of the following enzyme belos in digestion of to, Invertues (b) Trypsin (c) Tyrosinase .d) Ureas IJ K C.E.T 2015. B58. The statement that is not correct as ta aldree and ketose augars in alkeline medium do entreba as not sermerise (c) puring _ b) carbuhydrates are optically active e umoi. (c) pentaggetate of glucose does not react with hydroxy,amine. (a. Jondane d) Inclose has giyeosidio ankage between C, of glucose in cysteme. and C, of gelactose unit. Karnatake CET 2014 (e isoleucine B59. Which one of the following is an essential rating said? (a) Cysteins 76. Serion (c. Maltose (c) Tyrosine (d) leoleacine for Sname Karnataka CET 2015. .e. Fructose Boo. Adenosine is an example of (a) purine base (b) audeomde TG (c) mudientide (d) pyromitme base C G TA C Karnatake CET 2018 B61. Glyrogen u (a) a structural polyenechande test* (b) structurally similar to amylopectin but extensively 4c. Surrose ursuched to Pass (c) a polymer of β-D- glucose units (d) structuredy very much similar to amytopectur. Komotoka CET 2015 B62. Within the list shown below the correct pair of structures of aiamos in pH ranges 2-4 and 9-11 is éc. edenine base. I H,N'-CH: "H,JCO,H II H.N.-CHICH, ICO. III Han' -CHIOHA CO, in, Insulin IV H,N=CHCH,ICO,H /c/ testosterone (n) I. II (b) I, III (d) III, IV c) II, III WB 4EE 2015. B78. Pick the wrong statement from the following: B63. During conversion of glucose arts glucose symmolystrin. (c) Consumption of citrus fruits and green leafy what functions, group/autor of glucose is replaced? regetables in food prevents scurvy o bydrogen (b) Deficiency of vitamin B₈ pyridoxine) results in (b) aldehydic group озаучивнова (c) primary alcoholic group (c) Sources of vitamin B, are yeart, milk, green (d) secondary alcoholic group. (MH CET 2015 vegetables and cereda B64. Which of the following proteins is globular? (d) Deficiency of vitamin D causes Xerophthalmin deposition to (b) Albuman (c) Myonin (a) Fibroin MH CET 2018.

B65. Glucose on oxidation with bromine water yields gluconic scul. This reaction confirms the presence of (o, six carbon atoms hoked in straight cham. the recondary alcoholic group in glucies debyde moun in glucose. (d) pruntry alcabobe group in gluenes MH: CET 2016) B66. In double strand helix atmeture of DNA, heterocyclic base cytasine forms bydrogen bond with for guanine . (d) libyamme (Kerale PET 2016) B67. The amuno and containing mercaptan unit is the glutemine (d) Ivaine (Karala PET 2010) 1908. Which one of the following is a non-reducing sugar? the Lactose (of glucose (Keralo PET 2016) 209. Which of the following is correct about H-bonding in DNA? 30 A 3. T CAATT Kamataka CET 2018) B70. Which of the following gives positive Fehlings solution **6** Glarose (d) Protein Karnataka CET 2016) B71. ADP and ATP differ in the number of To ribose unite (c) phosphate ands (d) nitrogen atom WB JEE 2017 B72. Hormones are secreted by ductless glands of human body Indine containing hormone is (b) adrenalme (d) thyromae

Kamataka CET 2017:

Karmataka CET 2017)

B74. The letter D' in D-carbohydrates represents

- a) destrurotation
- (b) direct synthesis
- (a) configuration
- (d) mutarotation
- (e) optical activity

(Karnataka CET 2010, Keraja PET 2017

B75. The glycosidic linkage present in sucrose is between

- (a) C 1 of ar-glucose and C 2 of \$-fructose
- (b) C 1 of β-galactose and C 4 of α-gineose
- (c) C 1 of 0-glucose and C 4 of 0-glucose
- (d, C 1 of α-glucose and C 4 of β-fructose

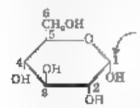
Karnatake CET 2017

B76. Which of the following product(s) is/are formed when fractose is treated with Na-Hg in water?

- (a) Sorbitol and Mannite.
- (b) Sorbdol and a-Hexane
- fc) Mannitol and a Hexane
- fd, Glucome acid

W K CET 2018.

B77. What is the relationship between the given structures look at the arrows?"



OH OH OH

а-Б-Фисоругарове

- B-IMBiacopyranose.
- (a) Engatemera
- (c) Diestereomera
- **心。Anomers 何)Metamers**

GIK, CET 2018.

B78. What is the correct explanation of the non-reducing property of sucrose?

- (a) δ-D-gluropyranose and β-D-fractofirances are linked via C, and C, centres respectively
- (b) 6t-D-glucopyranose and β-D-fractoffirmness are unked via C, and C_r centres respectively
- (c) α-D-glucopyranose and β-D-Guetafuranose are unked vin C, and C, centres respectively
- (d. c.D-glucopyranose and β-D-fructofuranose are linked via C, and C, centres respectively

JK, CET 2018.

B79. What will be the nature of excelence of an ammo and containing one canno and one carboxylic oxid group) in solution of pH < pK_m?

- (a) It exists as anion
- (b) It exists as cation
- fc) It exists as switter ion
- d. It exists as neutral species with no charge

WK CET 2018

B86. The two forms of D-glucopyranose are called

fo, destereomers

the anomers

и аримета

oremotioners 😼

Kemataka (ET 2018

B51. The glycosidic linkings involved in linking the glucose units in anylase part of starch is

(a) $C_1 - C_4$ \$-linkage (b) $C_1 - C_6$ a-linkage

(c, C, C, f-itnkage /d/ C, C, a-linkage

Karnataka CET 2018,

BSQ. The natrogenous base present only in RNA is

fo, guenne

(b) adenine

(c) sytosuna

e (d) praci

e, thymne

(dz uraci. (Karala PET 2018)

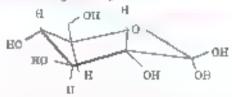
JEE (Advance) for HT Entrance

Arrange in order of increasing acid strengths

- 9 X > Z > Y
- 6 Z < X > Y
- c X > Y > Z

BB4. Celluluse apon acetylotion with excess seetic anhydrider H SC₃ cate yirriginas calviloss basectars admos structures is

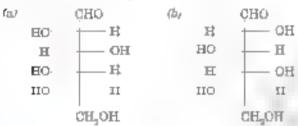
B85. The following carbohydrate is



- to a kerohexose
- (b) en aldohezose
- (c) an o-furance
- .d) sn u-pyrsoose (I.I.T 2011

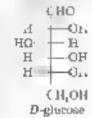
B86. The structure of D-t+>-glucose is

The structure of LA reduces as

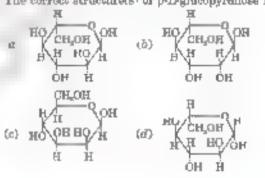


JEE Advance 2016)

B87. The Fiether presentation of D-glucuse is given below



The correct structure(s) of β-L-glucopyranose is are



JEE Advance 2018:

B66. (b) B86. (a) B87. (d)

MULTIPLE CHOICE QUESTIONS

with more than one correct answer

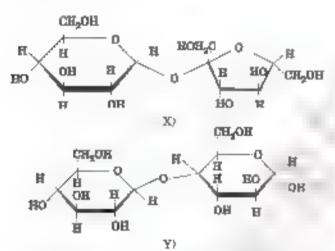
- C1. Carbohydrates which give two molerales of monoserchendes are called dissechandes. These are
 - n malvose
- b colluines
- (c) maitase
- d) lactose
- C2. Starch is a meeture of
 - (a) amylum
- (ð) amylapestin.
- (c) amylose
- ,d) β-D-glucose
- C3. Which of the following are essential amino acids?
 - a: Velime
- (b) Lysine
- Autome
- da Serine

- C4. Which of the following contain transition metal?
 - a) Vitacuo B
- (b) Chlorophyll
- .c' Haemoglobia
- of DNA
- C5. Which of the following has glycocidic linkage?
 - a) Maltasa
- (b) Amylose
- Gazactinee
- .d Sucrose
- C6. Fibrote proteins are present in
 - d allybeid
- о ыртатав
- (c) enlingen
- (d) fibroin
- C7. The substituted pyramidines are
 - U MEBIS.
 - a adeume
- (d) guanue

- CL (a), (d)
- C2. (b), (c)
- C8. (a). (b).
- C4. (a), c)
- C5. (1), (61, d)
- C6, m', v), (d)

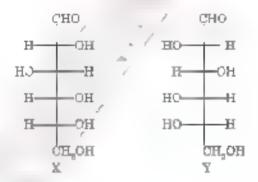
C7. 8 c

- C8. Which of the following statements talare correct?
 - a) Adenine and cytomoe are substituted purious
 - b) the sugar present in DNA nucleoxide is decay ribose
 - (c) RNA contains ureful instead of thymine present in DNA
 - d) In nucleic acids, a phosphate group is bonded to a hydroxyl group of sugar
- CO. Which of the following statements is/are out true?
 - a) Collegen in tendons is a globular protein
 - b) Keratan protein present in heir has tr-helix structure
 - (c) Congulation of albumin present in white of an egg is an example of denaturation of protein.
 - d' The enzymes are not specific in nature.
- C10. The correct statement(s) about the following sugars X and Y stars



- (a CK to a reducing sugar and T) to a non-reducing sugar
- X is a con-reducing sugar of Y is a reducing auger

- The glycoerdic linkages in X) and Y are tt and β-respectatery
- (d) The glycomide ankages in (X and (Y) are β and Grespectively JIT JEE 2009*
- C11. Among the following statements about the molecules X and Y the one(s) which is are) correct is (are)



- (a) X and Y are dinstereomers
- b) X and Y are ensutiomers
- (c) X and Y ere both aldohexoses
- of X is a D ought and Y is an Langue WB JEE 2014
- C12. For invertaugar the correct statement, a stare) Given specific rotations of + sucross + + multiple L→ glucose and L→+ fructose in aqueous solution are +60° +140° -63° and +93° respectively.
 - a) 'invert augar' is prepared by and catalyzed hydrolysis
 of manage.
 - (b) "invert sugar" is an equincolor maxture of D-(+)glumes and D-(-) fractose
 - ic specific rotation of invertigueer is 20"
 - d) on reaction with Br, water invertisigan terms seecheric and as one of the products. "IEE Advance 2016"

CB. (b), (c), (d)

('9. do. d)

C10. b., (c)

C11. (b), (c), (d)

C12. 64.(c)

Passage L

Monascollandes are polyhydres aldelydes and ketones which cannot be hydrolysed into simpler carbohydrates. The monascohardes containing — GHO group are called aldoses while those containing $\mathbf{C} = \mathbf{O}$ group are called ketoses. The aldehyde group is always present at \mathbf{C}_1 while keto group is generally present at \mathbf{C}_2 . All monoscohardes are exided by Tollen's reagent and Fehling solution and are called reducing

sugars. The monoscubande molecules may be assigned D and L-configurations depending upon whether the configuration of the molecule is related to D or L-giyeraldeliyde. If the "OH group is attached to the carbon adjacent to the "CH_OH group last chiral carbon is on the right hand side, it is assigned D-configuration. The molecule is assigned L-configuration of the "OH group attached to the carbon adjacent to the CH_OH group is on the last The monoscurbandes contain

one or more chiral carbon atoms. Pentoses and heroses have cyclic structures—furnose (five membered and pyranose (six membered). During sychnetian, C_1 in alduberoses and C_2 in fructuse become thiral and the newly formed. OH group may be either on the left or on the right in Fischer projection formulas. These monoserchandes therefore, exist in two stereonomerod forms exhed the nominer and β -anomer while C_1 and C_2 are called glymastic or anomeric carbon. The bonds printing glymastic carbon are called glymastic linkages. D(ϵ glucose exists in two stereonomeric forms: or D-glucose and β -D-glucose. When either of these two forms of glucose i.e., it-D-glucose are dissolved in water and allowed in stand, these get allowly converted into other form and an equilibrium mixture of both is formed. This process is called mutarotation.

D (

MULTIPLE CHOICE QUESTIONS

based on the given passageromprehension

Answer to following questions

- DL. The pair of optical isomers of glucose which differ in the configuration only around C₁ stom are called
 - a) epimers
- (b) Fischer projections
- r mnomere
- d moterotations, isomers
- D2. The maximum number of optical isomers of glucuses expected are
 - a, 8
- 5 12
- d) 2i
- Dil. Which of the following statements is not correct ?
 - ta Monosaccherides reduce Tollen's reagent.
 - (b) On dissolving & D-glucose in water having specific rotation 11.º its specific rotation decreases

(c) 16

- c) Glacose is aidobezose white frictings is ketobezose
- d) In D-glucose, -OH group is present to left at 5th carbon atom.
- D4. Two forms of D-glucopyranose are called
 - (a ephners
- (b) anomers
- (c) enanbonera
- with dinetomers.
- DS. Mutarotating does not pecur up
 - ด สมาเจยล
- b Lightcose
- (c) Legiumasa
- d) come of these
- D6. Which of the following pairs give positive Tollen's test?
 - а. Звисове вистове
- Glucose, fructose
- (c) Hexanni, nestophanone
- d' Fruntose, sucrose

CLEA SUKHL

Passage II.

Proteins are high molecular mass complex biomolecules of annno suda. The unportant proteins required for our body are enzymes, hormones, antibodies, transport proteins, structure. proteins, contractile proteins atc. Except for glycine al. O-raming oxide have charal carbon atom and have L-configuration. The animp acids exists as dipotar ion called zwitter ion, in which a proton goes from the earbacyl group to the emma group. A large number of @-amino acide are joined by peptide bonds forming polypeptides. The peptides having very large molecular mass. more than 10,000° are called proteurs. The structure of proteins is described as primary structure giving sequence of inding of amino mode, e-condary atmobire giving manner in which polypeptide chains are arranged and folded; terttary structure giving folding ceiling or bonding polypeptide chains producing three dimensional structures and quoternary structure giving arrangement of sub-mosts in an appregate protein medicule

Answer the following questions

- D7. Which of the following ct-amino and does not form optical isomers ?
 - (a) N*H, CH(CH₀, COO
 - (b) N°H, CH, COO
 - (e) N°H, CH(CH,Fb' COO-
 - d) N°H, CH[CH] COO
- D8. Which of the following statements is not correct ?
 - (a) Ammo acids exist as zwitter ions
 - All naturally occurring 0-emmo acids have NH₂ group on the right
 - c. Except givens, all other naturally occurring a-grano acids have a chiral carbon atom.
 - d) The basic character in tramino ande te due to the -COO group
- DS. All proteins on hydrolysis give
 - (a) peptades
- (b) re-summe sends
- (c) ammee and carboxylic acid residues
- (d) enzymes
- D.0. The sequence in which simino acids are arranged in a protein is called.
 - a premary structure to secondary structure
 - a tertainy structure of configuration.
- D.1. Which of the following is not a class of proteins?
 - (p) anzymes
- (b) hormones
- e antibodies
- .d lipsus

Passage I: DI c	D2. r	D3. d	D4. b	D5. a	D6. b
Passage II: D7 b	D8. 6	D9. b	D10. ₁α	$D1a \cdot d$	

Assertion Reason Type Questions

The questions given below consist of an Assertion and Reason. Use the following key to choose the appropriate answer

- (a) If both assertion and reason are CORRECT and reason as the CORRECT explanation of the assertion
- 5 If both assertion and reason are CORRECT but reason as NOT THE CORRECT explanation of the assertion.
- 4 H assertion is CORRECT out reason is INCURRECT
- d) A secretion a ENC RRECT but remean is D RRECT
- (e) If both assertion and reason are INCORRECT
- Assertion : Giycosides are hydrolysed in acidio conditions

		COLLEGISONE	
	Reason	Glycosides are scetats. A.I.I.M.S. 3t	100
3,	Assertion		
		vary but an hydrolysis at presence of I	
		trydruchiomic acid is decorates (severorate)	c'l'

Reason Sucrose on hydrolysis gives unequal amounts of glucose and fructuse as a result of which thange in sign of rotation is observed.

 Assertion Fets and our are one of the main sources of food for all laving organisms.

Rendom 1 Lapide act on energy received

4. Assertion The newly formed RNA director the synthesis of protein at the ribosome

Reason I DNA has a doubte beliefs structure white RNA has soutle strauded structure

5. Assertion t Urnei, as present in DNA.

Reason | DNA andergoes replication.

6. Assertion : Cellulese is not digested by human beings

Reason: Cellulose is a polymer of B-D-glususe

 Assertion Vitamin: A and D are not absorbed in the body unless to digestion and absorption proceed mornally

Reason : Vitamo A and D are fat soluble vitamos

 Assertion Except glycine of naturally occurring tenning ands are optically active.

Reason All a-ammo acids occurring naturally except glyone has at least one asymmetric carbon.

9. Assertion listilio is a globular protein.

Researce Gusbuler protecte are were soluble.

10. Assurtion Fructose does not contain an aidebyde group but stall reduces Tollen's reagent

Hencon : In the processes of a base fruction undergree rearrangement to form glurges and manness.

1. (a) 2. (c) 8. (a) 4. (b) 5. (cf) 6. (b) 7. .a) 8. (a) 8. /a, 10. (c.

Matrix Match Type Quset.on

Each question contains statements given in two columns, which have to be matched. Statements in Column I are abelied as A, B. C and D whereas statements in Column II are labelled as p. g. r and s. Match the entries of Column I with appropriate entries of Column II. Each entry in Column I may have one or more than one correct option from Culumn II. The answers to these questions have to be appropriately bubbled as illustrated in the following example.

If the correct matches are A-q, A-r, B-p, B-r C-r, C-r and D-q, then the correctly bubbled matrix will took also the following:

	p	q	1	- 10
A	(P)	(1)	①	B
В	(P)	(0	(B)
C.	(P)	(1)	0	(6)
D	(P)	(1)	1	$^{\circ}$

 Match the carbohydrate in Column I with its characteristic given in Column II

Colu	ımı I	Column II	
- A)	Lactose	(0)	Ketobesore
B)	Stareb	(q)	Diascellande
(C)	Euerose	(r)	Polyanocharide
Di	Fructoss	(11)	on hydrolysis gives β-D-glomes and β-D-galactore

Metch the carbohydrate in Column I with its characteristic given in Column II

Column I			Column II
A)	Kernton	(p)	proteus
В	Haedogobio	4	β-prested protein
(C)	Ribottavan	(r)	n-aounn seid
D.	lyrine .	2	Weter coluble interna

Integer Type Questions

Integer Type: The mawer to each of the following question is a single-digit-integer ranging from 0 to 9.

- Among the following cotal number of essential manne soids Leucine A same Pheny's same Promise Threonine Lysine Historie Arginine Cystems. Tryptoman, Service Value is
- The number of pripepades formed by three same acids given around and serine is
- The number of chiral carbon atoms present in β-D (+)-giucose is
- The number of peptide hormones among contains testoecorone oxytoria hyroxine, vanopressin, cortisone is
- 6. The number of intercluble vitamins among D. K, B_{12} (*) B_{1} , B_{22}
- d. The substituents R_1 and R_2 for one peptides are usted to the table given below. How many of these peptides are positively charged at pH = 7 i.7

Peptide	R ₁	R ₂
T	H	H
II	H	r_{H_1}
ĬΠ	ен,соон	н
IV	CH,CONH _a	CHUNH.
V	CH'S MH'	CH ₂ C /NH
VI	The North	CH_{2} $^{4}NH_{2}$
VII	· Har PH	CH_nCONH_2
VIII	74, dt	CH1.4NH3
1X	CH, NH ₃	₹H ₂

(LIT J.EE 2012)

7 When the following adobescess exists in its D-configuration, the site cumber of stereousceness: note pyranose form is

CHO

ĊH.

THOH

CHUIL

CHOH

CHLOH

. 1 T JEE 2012

A tetrapeptide has COOH group on alanme. This
produces glyoine (Gly), value (Vni., phenyl-alanme
Phe) and alanme. Am, on complete hydrolysis. For this
tetrapeptide, the number of possible sequences, primary
etratures with NH₂ group attached to a chiral center is.

M E E Advance 2010)

18 2,8 3,7 43 5,3 0,4 7.8 8.4



NCERT

Exemplar Problems



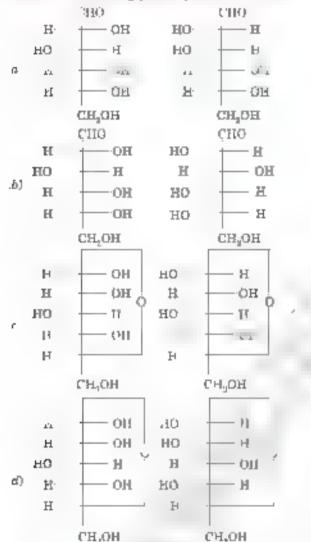
- Multiple Chaics Questions (Type-I) -- :

 Glycogen is a branched chain polymer of α-D-glucase units in which chain is formed by C₁ · C₂ glycosidic linkage whereas branching occurs by the formation of C₁ · C₂ glycosidic linkage. Structure of glycogen is similar to

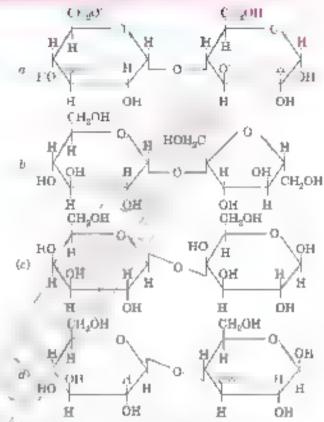
Objective Questions

- (a) Amylose
- b' Amylopectan.
- (c) Collutose
- (d' Glucose
- Which of the following polymer is stored in the liver of annuals?
 - to. Amylaes
- b) Cellulose
- (e) Amylopectan
- d Glymgen

- Sucrose cane sugar) to a disaccharide. One molecule of sucrose on hydrolysis gives
 - ,z) 2 molecules of glucose
 - b. 2 molecules of glorose + I molecule of fructore
 - molecule of glurose + 1 molecule of fructose
 - a) 2 molecules of fractose
- 4. Which of the following pours represents enomera?

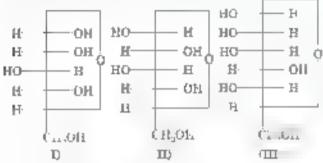


- 5. Proteins are found to have two different types of secondary structures viz α-helix and β-pleated sheet structure α-helix structure of protein is stebblised by
 - a' Peptide bonds
 - b) van der Waais forces
 - e) Hydrogen bonds
 - d. Dipole-dipole Dieractions
- 6. In disaccharides, if the reducing groups of monoeaccharides i.e. aidehydir or ketonic groups are bonded, these are non-reducing segure. Which of the following disaccharide is a non-reducing sugar?



- 7 Which of the following soids is a vitamin?
 - n. Aspertue need
- Ascorbic mad.
- (c) Adipir and
- of Seccharge acid
- 6. Dimerleutide is obtained by joining two nucleotides together by phosphodiester unlarge. Between which rarbon atoms of pentone sugars of nucleotides are these unlarges present?
 - (a) 5' and 3'
- (b) 1' and 5
- (c) 5 and 6
- d 31 and 31
- D. Nucleic acids are the polymers of
 - to. Nucleosides
- (b) Nucleotides
- (c) Bases
- (d) Sugare
- 10. Which of the following statements is not true about glucose?
 10. It is an aldohexose.
 - b. On heating with HI + forms wherens.
 - (c) It is present in furanose form
 - d' It does not give 2,4-DNP test
- 11. Each polypeptide in a protein has aminoacide linked with each other in a specific sequence. This sequence of amino ucula to and to be
 - (a) primary structure of proteins.
 - (b) secondary structure of proteins.
 - (c) termany structure of proteins.
 - (d) quateronry structure of proteins.

- 12. DNA and RNA contain four bases each. Which of the following bases is not present in RNA?
 - a, yqenma
- to Ume.
- c Thymine
- d d'ylosine
- Which of the following B group vitamins can be stored in our body^o
 - a Vitamin B
- (b) Vitamin B.
- e) Vitamon B.
- d) Vitamin B,
- 14. Which of the following bases is not present in DNA?
 - a' Adenine
- (b) Thymine
- e) Öytesine
- d) Uracı.
- 15. Three cyclic structures of monosnechandes are given below. Which of these are anomers?

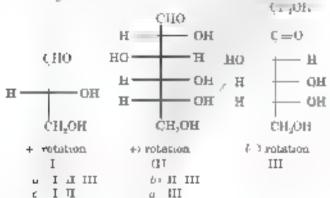


g' I and H

12. .c)

13. .d)

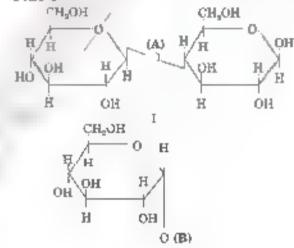
- (b) II and III
- e) I and III
- d) ill is anomer of , and L
- 16. Which of the following reactions of glucose can be explained only by its cyclic atruckure?
 - Glucose forma pentascetate
 - Glucose reacts with hydroxylamine to form attomice.
 - Pentancetate of glacose does not reset with hydroxylemme
 - d) Chaose is exidused by nitric soul to glucome send.
- 17. Optical rotations of some compounds along with their structures are given below. Which of them have D configuration?

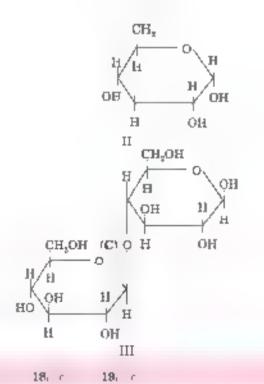


48. Structure of a disaccharide formed by glucose and fructose is given below Identify anomeric carbon atoms to introsercharide touts

15. (a

- a in carbon of glurose and in certain of fractione
- b a carbon of glurose and a carbon of fructose
- c is carbon of glumme and is carbon of fructuse
- (d) f' carbon of glucose and f' carbon of fructors.
- 19. Three structures are given below in which two glucose units are linked. Which of these inkages between glucose units are between C1 and C4 and which linkages are between C1 and C6?





- a' .A is between Ch and C4, B and C) are between C1 and C6
- b) (A. and B. are between C1 and C4, C) is between C1 and C6
- c) (A. and (C) are between C1 and C4, B) is between C1 and C6.
- d) (A and (C) are between C1 and C6, B) is between C1 and C4

- Marbieli

Mubble Chaics Questions (Tues-III)



- Note : In the following questions two or more options may be carrect
- 20. Carbohydrakes are classified on the base of their behaviour on hydrolysis and also as reducing or non-reducing sugar Sucrose is a
 - a) monnaachande (b) diaachande
 - c) reducing sugar d) non-reducing sugar
- 21. Proteins can be classified into two types on the basis of their mulecular shape i.e. filtrons proteins and globular proteins. Examples of globular proteins are
 - a. Inserpu
- (b) Keretan
- e) Adumon
- .d) Myosus
- 29. Which of the following carbohydrates are branched polymer of glucose?
 - c Amylese
- (b) Amylopechin
- c) Cellulose
- (d) Glycogen
- 28. Amino sende are classified as sendre, basic or neutral depending upon the relative number of amino and carbony! groups in their milecule. Which of the following are sende?
 - a) (CH₀HCH—CH -COOH

 NH_1

b HOOF CH_s—CH_s—CH—COOH

NH.

- o H.N. CH. CH. CH. COOR
- d) HOOC-CH_CH-COOH

NH.

24. Lysins, H₀N--(CH_{0/c}--CH--COOH =

NH

- a' te-Amino acid
- b' Bosic amuno serd
- c) Amon and synthesized in body
- d) B-Amino seid
- 25. Which of the following monoenechnrides are present as five membered cyclic structure: furnouse structure??

- a) Ribose
- & Glucose
- (c) Proglass
- .d) Grunctose
- 26. In fibrous proteins, polypeptide chains are deld together
 - (a) van der Wants freres
 - diaulphide linkage
 - c' electrostatic forces of attraction
 - d) bydrogen boods
- 37. Which of the following are purise bases?
 - e Guanne
- h Adecune
- e Thymne
- d Umail
- 28. Which of the following terms are correct about enzyme?
 - (c. Protecus
- 6 Panacleotides
- e) Nucleic acida
- d) Brocatalysts



Note Match the Items of Cotumn I and Column II in the following questions. More than one option in Column I now morely with the items given a Column I

20.Match the vitamina given in Column I with the deficiency disease they cause given in Column II

Column I (Vitamina)	Column B (Diseases)		
a) Vitamin A	(r) Permicione anaemia		
b Vitamin B.	(ii) Increased blood eletting him		
tel Vitanii B _{ro}	(aii) Xecophthalman		
(d' Vitamin C	m) Rickets		
,s Vitamin D	(a) Magnutar weekness		
(/) Vitamin E	or) Night blindness		
a Vitamin K	(vd) Hen Ben		
	(pitt) Bleeding guma		
	er) Osteomelacia		

50.Match the following enzymes given in Column I with the reactions they estalyse given in Column II

Column I (Enzymen)	Column II (Reactions)
(a) Invertass	 Decomposition of area into NH₂ and CO₂.
b Maltase	H Conversion of glucose into ethyl acobol.
с) Ререко	and Hydrofysia of maltosa min glucoae.
d) Urease	, to Hydrolysis of came augur
ar) Zymnes	(v) Hydrolysis of proteins into peptides.

Resertion and Reason Type Questions

Note t In the following questions a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following charges.

- Assertion and reason both are correct statements and reason explains the assertion
- b Both assertion and reason are wrong statements
- .c) Assertion is correct statement and reason is arong statement
- d) Assertion is corond statement and reason is correct statement.
- Assertion and reason both are correct statements but reason does not explain assertion
- Assertion D(+, Glucose is destroyotatory in nature. Reason 'D' represents its derirorotetory nature.
- 32. Assertion I Vitamin D can be stored in our body Reason Vitamin D is fat soluble vitamin
- 38. Assertion . B-glycosidio linkage is present in insituee,

CH.OH CH,OH H

Reason : Maltone is composed of two glucose units in which C-1 of one gineese unit is linked to C-4 of another

- 84. Assertion , All naturally contring transmissible except glycine are optically active Reason : Most naturally occurring amino ands have Leomfiguration
- 85, Assertion : Decayribore C₂H₁₀O₄ is not a carbohydrate Heason I Carbohydrates are hydrates of carbon so compounds which follow $C_i(\mathbf{H}_i O)_i$ formula are carbohydrates:
- 36. Assertion : Glycine must be taken through diet Ressure. It is an essential amuno and
- Assertion : In presence of enzyme substrate molecule can. be attacked by the reagens effectively Reason : Active sites of enzymes hold the substrate molecule. un a antiable position

31. (c)

89. (a)

83. (4)

84. (*)

35. (1)

36. (5

87 o

Hints & Explanations for Difficult Objective Type Questions

A. Topicieise multiple choice questions

A1. (b) Chicage and fructoes have emperanter denoting $C_aH_{a0}O_a$ but have different functional groups, CHO (glucose) and > C = O (fructoses.

A7. (b) CHO

- A12 (d) Clucies is present in pyranose form and it is never present in furmiose form.
- A19. (c. Alanine in CH_CH-NFL, and existe as Zwitter ion,

CH, CH NH.

In basic medium, it ieses a proton as

CH.—CH—NH. Barre COO

During denotication of proteins, secondary and sertiony structures get destroyed but primary atmictaire remains on such

Keratin and fibroin are fibrous proteins.

A80. (d) 2 Viltamm B₁₀ can be stored in our body

A42. (d) : Thymine can bond to adenue by 2 hydrogen bonds

A44. (c) 7 Biotin is vitamin H

B. mcg from Competitive Examinations

- Bp. .e* Loctose is a reducing sugar and all reducing sugars. show muterotation.
- B20. (c Denaturation of proteins loses its biological activity and makes it less active.
- H21 , a Amylose is a linear polymer of a-D-glumus inked to one another through glycosidic unkages involving C, of one glucose and C₄ of next glucose i.e. 1-4. u-linkage. Amylopertin is a branched chain polymer of a-D-glucose units in which chain is formed by $C_{i^{\prime}}\cdot C_{s}$ α -linkages and branching occurs by $C_{i^{\prime}}\cdot C_{s}$ o-glycoeidic ankagas.
- B22. .c In DNA molecule, only A and T and G and C can combine. A and T are joined by two hydrogen bonds. while G and C are joined by three bydrogen bonds * TACGAACT ATG/TFGA

- **B26.** a CH_OH_CHOH_CHO $\xrightarrow{h_{X} \cdot h_{X} \cdot h_{X} \cdot h_{X} \cdot h_{X} \cdot h_{X}}$ CH_OH_CHOH_COOH

 Shower Shower said
- **B27.** (c) Due to the deficiency of vitamin B₂ -riboflavin chemoastic cracking of hips and conter of the mouth and digestive disorders occur.
- B35.4b Glycine NH,CH₀COOH is optically discrive while all other simms ands are optically active
- B96.(a) Mollarh a test is used for the detertion of carbohydrates
- B41. (a) 'Sugars contaming free enomeric -OH group are reducing sugars.

HORIO O CHIOH free anomeric group

B43l. (a)

B48. .d) At pH 7.4, major form of histenine

CHO

B48. ANCHOH. 4 2 Agrinh 1/2 + 30H + (CHOH. 4

CH.OH

CH.OH

Churies

CH.OH

CHART

CH.OH

CHART

B49. (b) * Sucrose is a dissorbande made up of glucose and fractuse

Oly-ula

CHO CH = NNHC₂A₁

H−C−OH C₂H₁NKNR₁ H−C−OH

H−C−OH A1−C−OH

CH₂OH CH₂OH

CH₂OH

CH₂OH

CH₃OH

CH₄OH

CH₃OH

In decayribone, one -OH group is missing, which will prevent the formation of oserone

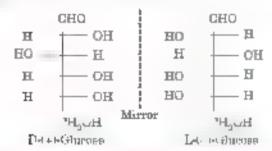
- B55, a CH₂ H(**): A *** H: H0 hd P *** CH₃, CH₄, CH₅ (CH₅
- B56. (b) † 51 amino acide era present
- B57 7b, t Trypein catalyzes the hydrolysis of peptide bonds, breaking down proteins into smaller peptides.
- B71. n) . ADP is ofenneme displacement and has two phosphate groups. ATP is adenosine triphosphate and has three phosphate groups. Therefore, ADP and ATP differ in number of phosphate groups.
- B78. (d) Deficiency of vitamin A causes Xerophthalmas and deficiency of vitamin D causes cickets
- B*4 * The letter D-in D-carbohydrates represents configuration A monosacobaride is assigned D-configuration if the OH group at the last chiral carbon lies towards right hand odd
- B75. c Glycosrdic linkage present in sucrose is between C-1 of α-glucose and C-2 of β-fructuse
- B77 b These are isomers which differ in position at C- x and are called anomers
- B78. .b Sucrose is a non-reducing sugar because both glucose (C_1 - α) and fructose (C_2 - β) are connected to each other through their reducing centres
- B79. .b' At low pH arithe solutions, COO sets as a base and accepts a proton to form the cation

384. α). Cellulose how β -glycosothe linkages between C_1 of one glorose unit and C_4 of the other It has three free OH groups at 2, 3, 6 positions and hence OAc group appears at C_5 , C_1 and C_6 positions.

Competition File

B85. b The carbohydrate has 5 carbon and one oxygen in the ring and hence it has pyranose ring. Further more C₁. OH is β-oriented, therefore the structure is β-pyranose. The carbohydrate has a total of six carbon about and has one. OH and one H at C₁, therefore, it is althoughten.

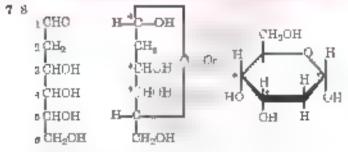
B86. at



C. meg with more than one correct answer

- (*10...b, c* In sugar (X), reducing ends of both the sugars are not free, hence it is a non-reducing sugar. In sugar (Y), reducing end at C₁ is free, hence it is a reducing sugar.
- C11. (b. c. d) X and Y are enautomers and not disater-conters. X and Y are both aldohexoses. But X- is a D-sugar and Y is L-sugar.
- (*13. b, c) Invertinger is an equimolar marture of DC++glucose and D-C+-fractose. The specific rotation, [a] of L-C+-glucose and L-C+-fractose are 52° and ±92° respectively. Therefore
 (a) of D-C++glucose = +52°
 (d) of D-C+-fractose = 92°
 Specific rotation of invertinger = 0.5 × [a] of D-C++ glucose + 0.5 × [a] of D-C+-fractose = 0.5 × +62°++0.5 × (-92°) = -20°

Integer Type Questions



Since the configuration is D cyclestion will occur at OH of 5th carbon atom.

Chural centres in pyrances structure, n = 3

Total stereoisomers = $2^{n} = 2^{n} = 8$

8.4 The four minio ands are

H₂N-CH₂ COOH Glycine G:

CH₂Ch₂ -CH COOh Volume V.

CH NH.,

(BI) CH₂CH -COOR Assume (A)

(so: C₀H₀ -CH₂—CH—COOH: Phonyl admino (P)

Since A m at the end and G does out contain a chiral centre, then all tetrapeptides begin either with V or P Thom, different options with NH₃ group attached to a chiral centre are:

(i) VPGA is VGPA in PVGA in PGVA.

NCERT Exemplar Problems MCQs Type-I

- 2. (d) Olycogen is stored in the liver of animals
- 8. c $C_{11}H_{12}C_{14} + H_{14} \xrightarrow{\text{cr.}} \frac{1}{6}H_{12}O_{8} + C_{11}H_{12}C_{14}$ Source Fractions
- 4. [c] Anomera are those cyclic beminestals which differ only in the configuration of -OH group at C, carbon
- 8. b) In option (b) reducing centre of gluesse a.e. C, as emmerted in the reducing centre of fractions at (b).
- 7. (b) Ascorbic ecid is vitemm C
- 10. c) Glacose is never present to furancee form.
- 19. c) Thymine is not present in RNA.
- 15. a Structures I and II differ only in the position of "OH group at C, and hence are anomers."
- 16. c) Due to the absence of free OH group at C₁, cyclic structure of glucose pentage eather cannot revert to open chain aldehydic form and hence cannot form oxime
- 17 a In all the three structures (I. Hand iII), the configuration of OH at C₁ as towards right and hence all have D-configuration.
- 18. c) 'a' carbon of glucose and 'b carbon of fructure

NCERT Exemplar Problems . MCQs Type-II

- 20. b, d) Sucrose is a disaccharide and is a non-reducing.
- 22. b. d) Amylopectan and glycogen both have branched charm structures These differ only in the number of glomes units in the chain length
- 24. a, b) Lymne is a basic or-amino and because it has two—NH_e groups and one —COOH group. It is not synthesised in the body
- 26. b, d) Disulphide ankages and hydrogen bonds
- 97 of hy. Adamse and greature are partito become
- 28. a. d. Enzymes are globular problems and act as morataly ats.



for Decord Brownson Sen.

Trans	allowed 2 Hrs.	Maxim im Marke	35
1	What are the products of hydrolysis of socrose ?		(1)
<u>60.</u>	Which enzyme is used to cure heart disease?	1	(1)
8.	What type of bonds hold a DNA double helps together?		(1)
4,	Name the purmes present in DNA.		(1)
5.	Which enzyme is present in saliva? What is its function?		(1)
6.	The two strands in DNA are not identical but are complementary. Explain this statement		43
7	Enumerate the reactions of glacose which cannot be explained by its open chair structure.		2)
8,	How do you explain the suppletene character of amino socia.		(2)
В,	What are the polysorchandes that make up stamb and what is the difference between them?		3
10,	What is glycogen? How is it different from starch?		(2)
11	Define the following terms as related to proteins (a) Primary structure (a) Peptide linkage		
	rus. Densturaum.		(8)
12,	What are essential and non-essential amino ands? Gost two examples of each type Explain the amino ands.	eningholem behavior	
13,	What happens when D-glucose is treated with		
	4. Broome water		
	A. Nitre and		
	Au HI		
14,	α' What are disacchandes ' Discuss the structure of sucrose		(3)
	b' What is materatation?		(9)
15.	Name the products obtained on comple a hydrolysis of DNA. Enumerate the differences between ways a nucleotide is different from nucleotide. Illustrate with sammples.	DNA and RNA. In v	asdw (B)
16.	(a) What are vitamine? How are these dansified.		
	b. Name the vitamins whose deficiency causes incheta in herr-ben in night handness.		
	c) Give two differences between hormones and vitamins.		(5)
			ده

 To check your performance see HINTS AND SOLUTIONS TO SOME QUESTIONS at the end of Part II of the book.





POLYMERS

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- Understanding Text
 Conceptual Questions
 HAPTER SUMMARY & OLDER
- CHAPTER SUMMARY & QUICK CHAPTER ROUND UP

NCERT FILE

- Instant Qu & Exercisea with Solutions
- NCERT Exemplar Problems with Answers & Solutions (Subjective)

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- Quick Memory Test until
 Answers
- HOTS & Advanced Level Questions with Answers REVISION EXERCISES

/w...b Previous Years CBS€ Qc & Other State Boards vs

 Hinta & Answers for Revision Exernise

UNIT PRACTICE TEST

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Topicvise MCQn
 Topicvise Executetron Qn

34

37

BB

43

47

- Medical Entrence
 JEE Man & ther State
 Bourds Engineering Entrence
- Boarda Eugmeering Entrance
 No ERT Entrapher Problems
- Hints & Explanations for Difficult Questions

With the development of science and rechnology man has been trying to prepare new and new compounds to fulfill his needs and make his life comfonzale. Polymers are one of the important products of chemical industry which have a great impact on our modern life. With the discovery of polymers, our daily the has become easier and colourful Plastics, synthetic fibres, synthetic rubber etc. are

문민

11

34

18/49

corourful. Plastics, synthetic fibres, synthetic rubber etc. are common examples of polymers. These polymers have multifactous uses ranging from household articles, chothes, furniture, children's royul packaging pags, an orrotal le tyres igears arto sea a electrical insulating materials, machine parts, etc. to space aircraft and biomedical and surgical operations. Indeed, the polymers are the backbone of four major industries such as plastics, elastomers, fibres, paints and varnithes.

PCLYMERS

Polymers are high molecular mass substances consisting of large number of repeating structural units derived from simple molecules.

In Greek, poly means many and mer means unit or part. They contain macro sized molecules and have very high molecular mass of the order $10^3 \cdot 10^5$ s. They are also called macromolecules. The repeating structural units are derived from some simple reactive molecules and are unked to each other by covalent londs.

The simple motecutes which combine to give polymers are caused monomers. The process by which the simple motecules i.e. monomers are converted into polymers a called **polymerisation**. For example, polyethylene or community known as polythene is a polymer which is obtained from its monomers ethylene by the process of polymerisation.

$$\begin{array}{ccc} nCH_0 = CH_0 & \xrightarrow{\text{Polymorization}} & + CH_0 + CH_0 +_n \\ & \text{Ethylene} & \text{Polyethylene in polythene} \\ & \text{modernees} & \text{polymbra} \end{array}$$

Polymers and macromolecules

The polymers are also called macromolecules because of their big size. The terms polymers and macromolecules are often used without any distinction But, strictly speaking, a polymer always consists of thousands of repeating monumer units However, a macromolecule is a grant molecule which may or may not contain monomer amits. For example, chlorophyllis a macromolecule but it is not regarded as a polymer because it does not contain monomers. However, polythene may be regarded as a polymer as well. as a macromo.ecule because it contains a large number of repeating monomers. Thus, all polymers are macromolecules but all macromolecules are not polymers.

It may be noted that polymers such as polysaccharides starchcellulose), proteins and nucleic acids etc. which control various also processes in plants and ammus are also called biopolymers.

Homopolymer and Co-polymer

A powere formed from one type of monomers is called homopolymer. For example, posythene is a homopolymer of monomer ethene. In this, the repeating attructural unit is CH_2 CH_3

$$nH_{3}C=CH_{2}\xrightarrow{\text{Polymerisation}} +CH_{2}-CH_{2}\to_{n} \text{ Homopolymer}$$
 Ethene Polythene

Some other examples of homopolymers are polypropylene polyvinyl chloride PV **, polymoprene polymerylomicale PAN*, solybeitodiene, etc.

A polymer formed from two or more different monomers is called no-polymer or mixed polymer. For example, hylon-66 is a polymer of two types of monomers beassmethylenediamine and adapte and

$$nH_2N$$
 ($CH_{2'6'}$ $NH_2+nHOOC$ (CH_2)_{4'} GOOH
Hexamethylenedianniae Adapte and

Total Polymerisation

+NH—(CH_2)₆—NH—CO—(CH_2)₄— CO — $\frac{1}{2}$ + nH_2O
Nylon-6.6 Constraint

Other examples of co-polymers are Buna-S, polyesters bakelite melamine formaldehyde, etc.

CLASSIFICATION OF POLYWERS

Polymers are classified in a number of ways as described below

- A. Classification based on source of availability
- B. Classification based upon structure.
- C. Classification based upon motecular forces.
- D. Classification based upon mode of synthesis.

A as besofte thou of Polymers on the Basis of Source of Avariability

The polymers can be broadly classified as

1 Natural polymers, 2. Synthetic polymers, 8. Semisynthetic polymers

1. Natural polymers

The potymers obtained from nature plants and animals) are called **natural** polymers. These occur in plants and animals and are very essential for the For example, starch, cellulose, natural rubber, proteins, nucleic scide, etc.

2. Synthetic polymers

The polymers which are prepared in the laboratories are called synthetic polymers. These are also called man-made polymers. For example, polymbytene, PVC, nylon, teflon, takeute, terylene, synthetic rubber, etc.

These polymers find diverse uses as in plothing, shelter, electric fittings substitute for wood and metals, household goods, etc.

Semisynthesic polymers

These polymers are mostly derived from naturally occurring polymers by mention modifications. For example, cell dose is a naturally occurring polymer Cell dose on acetylation with acetic analydide in the presence of subnume

POLYMERS

and forms cellulose discetate polymer. It is used in making threads and materials like films, glasses, etc. Other examples of semisynthetic propiners are innounced rubber (used in making tyres etc.) gun cotton which is cellulose intrate fused in making explosives, etc.

B. Classification of Polymers on the Basis of Structure

On the basis of structure of polymers, these can be classified as

- Linear polymers.
- 2. Branched chain polymers.
- 3. Cross-linked or network polymers.

1. Linear polymers

These are polymers in which monomers units are unsed together to form tong and answer that as. Fig. 1 a. These anear polymers are well packed and therefore, have ugh deast less high tensue pulling strength and ligh melting points. Some common examples of linear polymers are high density polythene, polyvinylchloride (PVC), nylons, polyesters, etc.

2. Branched chain polymers

These are polymers in which the autonomers are joined to form long that is, with side chains or branches of different lengths F.g. (b)). These branched chain property are pregunarly proked and therefore, they have low tens less trength and me ting points than linear polymers. Some common examples or

low density polythene, glycogen, storch, etc.

3. Cross-linked or network polymers

These are polymers in which monomer units are cross-linked together to form a three-dimensional network. These are also called three-dimensional network polymers. These polymers are hard rigid and brittle because of network structure. These are shown in Fig. 1(c). For example.

bakelite, melamine formaldehyde resta, etc.

t - Classification of Polymers on the Basis of Millecular Forces

A large number of applications of polymers depend upon their mechanical properties such as tensile strength elasticity toughness, etc. These mechanical properties depend upon intermolecular forces, know, der Was a forces, hydrogen bonds and dipole-dipole interactions existing in the macronic lecties. Atthingh these intermolecular forces are also present in ample an ierties, their effect is less aignificant in them as compared to macromolecules. This is because in the polymers, these forces extend also ong are chain resulting aignificant combined effect. Thus, longer the length of the polymer chain, alreager is the effect of intermolecular forces.

Depending upon the in ermoterular forces, the polymers have been classified into four types

- 1 Elastomers.
- 2 Fibres
- 3. Thermoplastics.
 - 4. Thermosetting polymers.

1. Elastomers

The polymers in which the intermolecular forces of attration between the polymer chains are the weakest and have erastic character like rubber* are called elastomers. Because of the presence of weak forces, the proviners can be easily stretched by applying small stress and regains their origina, shape when the stress is removed. The most important example of erastomer is natural rubber. These polymers consist of randomly could molecular chains of aregular shape having a few cross links. However, a few cross links are not

Fig. 1, Different structures of polymers.

- a Linear structure
- 5 Branched chain structure
- c. Prosa-united etmicsure.

Branchus Chain Pulymer

⁴ CH₂ C=CH=CH₂ +₆ CH₂ Natural rubber (elastomer)

^{*} A maxemal like rubber that can return to its original shape after stratching is said to be elastic

untroduced in the chains. For example, natural, rubber is a guinny material which has poor elasticity. It becomes soft and sucky when heated and becomes permanently reformed when stretched. However, when latural rubber is heated with 3–5% sulphur, it becomes non-sticky and more elastic. This process is called vulcanization and it was discovered by Charles Good Year in 1839. The product formed is on, ed vulcanized rubber which has better length cursticity and resistance to abrasion than natural nubber. This is due to sulphur cross links between polymer chains. Thus, cross links are introduced in natural rubber to

- mopert the property of regaming the original postumes after stretching force is released.
- The examples of elastomers are bunn-S, bunn-N, neoprene etc.

2. Fibres

These are the columners which he is strong cohomogratar forces because the chains. These forces are either hydrogen bonds or dispose-dispose interactions. For example, in case of polyamides such as nyion, the intermolecular forces are hydrogen bonding while in polyes era such as terviene or docron, etc., privacry in tribes such as in a serial, etc. the intermolecular forces are dispose-dispose interactions between polar carbonyl. C = n groups and between carbonyl and eyand. C = N groups respectively. Because of strong forces, the chains are closely packed and thus, impart crystalline nature. As a result the polymers have sharp melting points. These polymers are long, thin and thread like and can be weven in fabrus. Therefore, these are used for making fibres.

The common examples are nylon-6, 6, terylone, silk, etc.

3. Thermonlastsca

These are not not mere which can be easily colleged repeatedly when heated and hardened when cooled with the change in their properties. The alternatives are rees a these polymers are intermediate between those of elastomers and fibres. There is no cross linking between the chains. The softening for are as the polymer chains move more and more freely been use of absence of cross links. When bested they melt and form a fluid which can be mounted into any desired shapes and then cooled to get the desired product.

ommon examples of thermoplastics are polythene, polystyrene, polyvinyl chloride, teflon, etc.

4 Thermosetting polymers

These are the polymers which undergo permanent change on heating. On besting they undergo extensive cross inking between different polymer chains to give a three dun-asima network error. As a result, they become hard and infusible therefore, they cannot be reused. They are generally prepared from low molecular mass semi-fluid substances. When heated, they get highly cross by ked to form hard, in fusible and insolvible products. The cross in key hold the molecules in place so that heating does not allow them to move freely. Therefore a thermosetting posture is cross lanked or heavily branched indicate and is permanently rigid.

The common examples are bakelite, melamine formal dehade resta etc.

+ (l₂—(l +₆ () 1*Vi thermophistic

Dasic difference between thermosetting polymers and thermoplastic polymers at that the thermoplastic polymers can be softened repeatedly by assuming and and level on cooling we tout that age to properties. On the other hand, thermosetting plastics can be heated only once because it undergo permanent change on meeting and sets into a new solid which cannot be remelted. Therefore, thermoplastics can be moulded to any desired shape and can be processed again and again. But thermosetting materials cannot be moulded easily into desired shape and cannot be reprocessed. To forth articles with the desired shapes from thermosetting materials, the cross mixing inter be allowed to occur during the fabrication of the article.

D. Classification of Polymers on the Basis of Mode of Synthesis

On the bosis of mode of synthesis, the polymers may be classified as

Addition polymers. 2, Condensation polymers.

1. Addition polymers

A polymer formed by direct addition of repeated monomers without the entire on of by product morecules is called addition polymer. In this type the monomers are unsaturated compounds possessing double or triple bonds. The addition polymers have the same empirical formula as their monomers. For example, the addition polymers polythene, polyethylene, or polypropylene are obtained as

The polymers made by the addition of polymerisation of two different monomers are called co-polymers. For example, Buna-8, Buna-N, ric.

$$nCH_2=CH=CH_2 + nC_0H_3CH=CH_2 - c_{quilpmeninties},$$
 But in the constant of
2. Condensation polymers

A polymer formed by the condense, son of two or more than his monomers with the group detent of simple movemes who water a minimal hydrogen characteristic attribute etc. is called condensation polymer. In this type, the monomers generally have different bifunctional or tribunchonal groups. For example, my.on-6, 6 is a abtrance, by the condensation of we monomers, hexamethyleneosium and adapte acid with the ions of water molecules.

$$nH_*N + 4CH_{n-n} + nH_n + n + 0CC + 2H_*)_{q^*} + COOH + \frac{816R}{(8n^*)6H_2O} + Adapte need$$
 Hexamethylenediamone Adapte need

Some other examples of condensation polymers are terviene, bubelite, alkyl resins etc.

NOTE

Plasticizers. Certain plastics donot soften very much on beening. These can be easily softened or made flexible by the addition of some argan recompanies which are could plasticizers. For example, polywayl channels, PVC is very staff and hard but it is made soft and cubber axis by adding donor buty, pathological and planticizers.

Some other common piastoriers are doubty phthronics, creey imphosphotes, CH₁ C₂H₂ O ₂PC

Differences between addition polymers and condensation polymers.

	Addstron pulymers	Condensation polymers
-	Different monomers add in fermia polymer having same motorifor forming of the repeating structure, distribution of cuerting monomer	A arge comber of conteners combine with the loss of simple undecides H NH, HCLRCH is firm a polymer having molecular formula of the repeating simulation und different than that of starting monumers.
2	Nothing is not during polymerisation	Small motecules also H _a O. NH ₅ HCl. ROH are line.
Б.	Generally involves one monomer.	Invalves two monagers.
4	The monomers are generally onescurated compounds.	The motormers generally contain two
Ē	'emmon examples are polythene polythene. PVC. etc.	unnon exemples are nylon-66 erylene heltelas, etc.

TYPES OF POLYMERISATION REASTIONS

The polymerisation reactions never in the following two principal types

- (i) Addition polymerisation or chain growth palymerisation.
- (ii) Condensation polymerisation or step growth polymerisation.

ADDITION POLYMER'S ATTOM OR CHAIN GROWTH POLYMERISATION

Addition polymers are I study by the combination of monoriers without the elimination of some by product molecules. The monomers used in addition propers are the compounds such as a kenes, alkalienes and their derivatives. This polymerisation process involves a series of reactions each of which come are a reactive narticle and produces another sum at particle resulting a chain reaction. The polymerisation reaction is also called **chain polymerisation** to chain growth polymerisation because it takes paire through stages leading a increase in chain length and each stage produces reactive in emediates for use in the next stage of the growth of the chain take of each in reactions, it is type of polymerisation reaction also my vession initiator which may be a free reduced, a cation or anion. Depending upon if a reaction of the reactive species involves, the addition polymerisation occurs by the following three mechanisms:

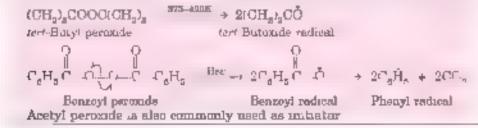
- Free radial addition polymerisation
- (ii) Cationic polymerisation
- m) Amonie polymerisation

H wever the free radical addition programmation is most common and is discussed below

Mechanism of Free Radical Addition Polymerisation

A variety of unsaturated compounds such as alkenes or dienes or their letivatives are polymerised by free radica, add two polymerisation in the presence of a free radical generating inhator catalyst like bendoyl peroxide and a performed by heating the monomer with a small amount of unsatur commonly peroxides; or by exposing the monomer to light.

'ert Buty- perecide and benzoy' peroxide are commonly used initiatars because they decompose under mild conditions to form free radicula.



The reaction involves the following steps

 Chain initiation. Organic perandes undergo homolytic fission to form free radicals which act as initiator (In*).

Peroxides + Rad'

acte as In

The initiator (In*) adds to the carbon-carbon double bond of an alkene molecule to form a new free radical.

(ii) Chain propagation. The new free radical adds to a louble would of monomer to form a larger free radical. The radical formed adds to another a kene molecule to form an even larger free radical. This process continues until the radical is destroyed. These steps are called propagation steps

Above steps are repeated until finally polymer is obtained

(iii) Chain termination. The above chain reaction terminates when the two free radicals combine. For example,

As, the steps for polymerisation of ether, e_n , the presence of benzoyl peroxide are shown below

Chain initiation step

Chain Propagating steps

$$C_0H_5$$
 CH_4 $C\dot{H}_2$ + H_5 $=$ $^{\circ}H_5$ CH_5 CH_4 CH_5 $C\dot{H}_5$ $C\dot{H}$

Chain terminating steps

COMPETITION PLUS

Certain alkene monomers can be polymerised by a cationic mechanism or amonic mechanism.

For detail refer Competition File (page 54).

BOLVED EXAMPLES

Example 1.—

B+NH CHR (CO), a homopolymer or a co-parymer?

N.C. E.R T.

So also A is a homopolymer because the repeating structural unit has only one type of monomer A. A. CHR—COOH

□ Example 2_

How does the presence of benzoque none which the free radicin paymer sation of a vinyl derivative?

Selection. Benziquinone combines with free radical intermediate to form a non-rescue ration which is highly standard by resonance. Because of the each of reactivity of the new radical formed it maibles the further progress of the diam resonant. Therefore, the reaction stops.

PREPARATION (F SOME IMPORTANT ADDITION POLYMERS

1. Polyethylene or Polythene

There are two types of polythenes as

a, Low density polythene (LDP)

(b) High density polythene HDP

Both of these are obtained from ethene and have the anne repeating structura, unit i.e., CH₂—CH₃— as discussed below

or Low density polythene (LDP). It is manufactured by heating pure envisors to 850-570 K under high pressure 1000-2000 atm in the presence of traces of oxygen 10 08 to 0.1%) or peroxide unitiator (catalyst, which initiates polymerisation.

It is obtained through the free radica, add, ion and hydrogen atom abstraction. It consists of highly branched chain molecules. Due to tranching the polythene molecules to not pack well and therefore, it has low density 6.92 g/cm³ and low meeting point 384 K). Low density proythene is chemically mert and tough but flexible and a poor conductor of electricity.

Uses. It is used

- (i) as a packing material in the form of thin plastic film bage
- all for insulation of electricity carrying wires and cabies,
- (14) in the manufacture of flexible pipes, toys, squeeze bottles, etc.
- (b) High density polythene (HDP). It is prepared by heating ethene in a hydrocarbon solvent at about \$83-848 K under a pressure of 6-7 at mospheres in the presence of a case yet such as triethylal-main and attain in tetrarblionde known as Ziegler-Natta catalyst.

$$_4$$
CH $_7$ =CH $_2$
 $_{2}$ 330.5 3 K, 67 atm \rightarrow CH $_2$ CH $_7$ + $_8$
Ethens
Polythene

This polymer consists of linear chains and therefore, the molecules can closely packed in space. It has therefore, high density 0.97 g/cm² and higher melting point 40° K. It is quite horder tougher at 1 has greater tousile strength than low density polythene. It is also chemically inert

Uses. It is used

- t, in the manufacture of contoiners (buckets, tubes, dustbins, etc.,
- ii) for the manufacture of different housewares, pipes, etc.
- 2. Polytetrafluoroethylene cheflon or P', PE', It is an addition polymer of tetrafluoroethene, it is obtained by heating tetrafluoroethene with a free radical or persulphate catalyst ammonium persulphate. $NH_{+}/_{0}S$, O_{ij} , at high pressures.

$$\begin{array}{ccc} \eta \, F_2 \, C = C F_2 & \frac{Catalysi, Hear}{high pressure} & + F_2 \, C \cdot C \, t_2 + \\ Tetralluoroethens & Taflon \end{array}$$

It is very tough moterns and is chemically next It is resistant towards heat and attack by corresive reagents such as applie and bases. It is a our conductor of electricity.

Uses. It is ased

- i) as a material resistant to heat and chemical attack,
- a) for routing articles oil dissolvers to make them non-sticky as non-such utensits,
- for making gaskets, pump packings, naives, assistals, non-abricated bearings, etc.
- 3. Polyacrylonitrile PAN) or Orlon. It is a polymensed product of vinyl cyanide (acrylonitrile). It is obtained by addition polymerisation of acrylonitrile in the presence of a permide catalyst.

The monomer vinyl ryamide can be premared by treating acetylene with HCN in the presence of Ba(CN)₂ or GuCl—HCl catalyst:

$$HC = CH + H^{-1}N$$

Flore $^{N} \rightarrow H^{-1} = CH + CN$

Vioyl cyanide

If can also be prepared by passing a mixture of propens, aminoma and air over a catalyst consisting of a mixture of oxides of motybdenum cobatt and altitum up at 723 K

$$2CH_0CH = CH_0 + 3\Omega_0 + 2NH_0$$
 is the of March 2004 $\xrightarrow{\text{FSNK}}$ $2CH_0 = CH - CN + 6H_0C$. From the A_0 is a small A_0 in A_0 in A_0 in A_0 in A_0 in A_0 in A_0 is a A_0 in A_0 i

It is a hard, horny and high melting substance. It is also known as acrican or orlon.

Uses, It is used

as a sui istitute of woot for making blankets, sweaters, bathing suits, etc.,
 for making synthetic curpets.

CONDENSATION POLYMERS

These are formed by the condensation of two or more offunctional incommers with the elimination of simple incremes like water, enumerial alcoholistic. In these reactions, the product of each step is again a bifunctional species and the sequence of condensation goes by. Since, each step produces a distinct functionaused species and is independent of each other this process is also called

Vinyl chloride $CH_1 = CHCL$ and vinylidene chloride $(CH_2 - CC_{L_2})$ gives a copolymer Soran which is used as a film for wrapping food.

Teffon contings undergo decomposition at temperature above 860°C

R U Curious...



- ☐ What is super glue or crazy gate?
- Super glue or crazy glue is a polymer of methyl α-cyanoscrylate

Due to the presence of two electron withdrawing groups.

CN and COOCH₃ t. undergoes polymerisation very quickly It is one of very strong fast-acting adhesives of medical and household uses.

'yano acrylates i lhesives are sometimes knowa as instant glues.

NOTE

There a another commonly used aylon known as nylon-6, 10 hylon six-ten). It is a polymer of hexamethylenediamine six carbon atoms, and sebandanid ten carbon atoms,

as step growth polymerisation. Some common examples of condensation polymers are

1. Polyesters

These are poly condensation products of dicerboxylic acids and diols. These involve ester linkages

(**5-**0-)

For example,

(i) Tervierte. It is a polymer of ethylene giveol ethane-1,2-ho and terephthalic acid benzene-1 4-dicarboxy's acid. It is obtained by heating a mixture of ethylene glycol and terephthalic acid at 42% to 400 h in the presence of sinc scetate-antimony trionde, [ZaiOOCC H_{1/2} + Sb_{2/3}, ratalyst. It is known as terylene or discrom.

$$n \left[\text{HOCH}_2\text{CH}_3\text{OH} \right] + n \left[\text{HOOC} \left[\sqrt{\underline{}} \right] - \text{COOH} \right] \xrightarrow{420-400 \text{ K}} \frac{420-400 \text{ K}}{2 \times 000 \text{COH}_3 \cdot 2 + 8 b_2 O_3} \rightarrow$$

$$\text{Ethylene sheet}$$

Ethane : 3-drof

Веплене и чистевохубе возд

It was very strong fores. It is inglify crease-resistant, dorable and has low moisture content. It is also not damaged by pests ake moths and midew. Uses, It is used.

- i) in blending with cotton or wool fibres because it is crease resistant.
- (iii) as glass reinforcing materials in safety helmets.
- (ii) for making magnetic recording tapes.

Jyp* ...t.sapolymerofethy)eneglycol ethane 1 2-diol and phthanced (benzens 1 2-dicarboxylic acid).

$$n(HO-CH_2-CH_3-OH)+n$$
 COOH

Ethylene glycol Rinane _ 2-diol) Phthatic and (Benzene 4, 2dicarboxylic and

Glyptal

It is a network cross-linked polymer

(t) in manufacture of paints and locquers.

(a) for making his liding materials such as ashestos, cement, etc. 2. Polyamides.

These have amide linkages C-N in the chain. These polymers are

popularly known as nylons.

For example hylon-8.6 read as nyion arx and nyion-6 read as nyion arx

(f) No small.8. The alementer units of a ylon-4.8 are hexamethylenediamine and adipic acid. It is prepared by the condensation of hexamethylene diamine with adipic and under high pressure and high temperature.

Nylon-8 6

Uses. It is used

m making bristles for brushes,

ii) in textiles and also for making sheets. It is blended with wood to make socks and sweaters,

(ut) in the manufacture of cords and climbing ropes

(ii) Nylon-6. It has the monomer caprolactum which is obtained from cyclohexane

Coproaction on heating with traces of water gives a **-amino caproxe** note which is a mono-carboxylic amino and containing six carbon atoms. This polymerises to give hylm-6.

Uses, It is used to the man ifacture of tyre cords, fabrics and ropes

8. Formaldehyde remas.

These include polymers ake bakelite and melamine polymers.

The notation of the process setup of the presence of eather an acid or a base catalyst. The process actually involves the initial formation of or and/or p-hydroxymethylphenot derivatives. These react further with phenor to form compounds acting methy one. CH₂ bridges either a ortho or paraposition or both at ortho and para positions with respect to phenoic group. The initial product is mean product railed novolae which is also used in prints. This on further hearing with formaldehyde undergoes cross ankages to form infusible solid railed bakelite.

TONE MORE IMPORTANT

Kevlar

The fibres of this polymer are very strong and are used to make light weight bulletproof vests.

Nomex

.a a polyamide obtained by condensation of m-phthalic and and m-dramino benzene.

It has fire resistant properties and is used in protective clothing for fire-fighters, astronauts, and race-car drivers.

Leran

as polycarbonate or polyesurobtained by the condensation of diethylcarbonate and histographica

It has unusually high impact strength and is used for bullet-proof windows and safety or crash helmets.

Onprolactam a seven membered cyclic amide (cyclic amides are known as factams).

The condensation of o-hydroxybenzyl alcohol or p-hydroxybenzyl alcohol gives a linear polymer

The ortho and para substituted phenois can undergo polymerisation to produce a cross-linked polymer known as bake to. Novolac on tenting with formaldebyde siso undergoes cross linkages to form bakelite.

Baketite (Cross anked polymer

Novolac

Uses. Soft bakelites with low degree of polymerisation are used for making give for hinding randmated wooden planks and in variables. High, legree proportions prices hard bake also what hire used for making con his foundain pensiliborrous phonograph records, electrical switches and handles of carrous utensilis, formica table tops and many other products.

4. Melamine formaldehyde resin.

It is a polymer formed by the condensation of melamine which is a beterocyclic triamine with formuldehyde. The polymerisation occurs as

Uses. It is used in making unbreakable cronkers. These are used for making cups and plates which are quite hard and durable. They do not break on being dropped.

CO-POLYMERISATION AND CO-POLYMERS

We have a ready learnt that proposers made up of same repeating units are called **homopolymers** and polymers obtained from two or more different monomer units are called **copolymers**. The copolymers can be made by chain growth polymerisation as well as step growth polymerisation. It contains in tiple units of each monomer used in the same polymericalism. For example,

a murture of buto 1.3-diene and styrene can form a co-polymer known as butodiene-styrene co-polymer cailed hous—S.

$$cH = CH_{g}$$

$$nCH_{g} = CH + CH = CH_{g} + n$$

$$Cogolymarks.ion$$
Buta 1,3-diene Styrene
$$-CH_{g} - CH = CH - CH_{g} - CH - CH_{g}$$

Butediene-styrene copolymer Buna-S

Co-polymers have properties quite different from the homispolymers. For example, polystyrone, a homopolymer of styrone is a good electrical naulator end is moulded into toys, combs radio and television parts etc. But, styrone (25% and buta-1 8-diene 75% a co-polymer is very tough and is a good substitute for natural rubber. It has high abrasion resistance, high loading capacity and is used for the manufacture of auto tyres. Its other these high loading floor bles, footwear components, cable mentation, etc. Many ro-polymers formed from condensation reactions are also known.

NATURAL AND SYNTHETIC RUBBERS

A. NATURAL BUBBER

Rubber is a naturally occurring polymer. It is obtained as it ex from rubber troop. Rubber lates in a collected suspended of rubber in water. Rubber troop refound in tropical and semi-tropical countries such to form southern parts. Maisyers. Indonesia, Ceylon. South America etc.— is highly elastic. It can be easily deformed but regains to original so, pet fifter the stress is relieved. Therefore, it is also termed as elastioner. This elasticity makes is a valuable for a variety of uses.

Natura, rubber is a polymer of isoprene (2-methylbuta-1, 2-diene

$$CH_1 = C - CH = CH_2$$
Learning

(2-Methylbata-1,3-dieno)

In natural rubber about \$1.000 to 30. All asoprene units are linked together in a chain like arrangement as shown below

When n isoprene and a combine, the polymer has the formula

$$\begin{array}{c} - CH_{2} - C = CH - CH_{2} \\ \uparrow \\ CH_{3} \\ \end{array}$$
Polynsoprene
Notaral nubber

Copolymers are of fair year depending upon the distribution of minimum and in the chem

- Alternating copolymers in which two monomers alternate
 A B A B A B A B A B A B A B
- Block copolymers in which there are blocks of each kind of monomers alternating with each other
 AAABBBBAAABBBBAAABBBB
- Random copolymers in which the distribution of monostices is random.
 AARAS BABAABBAABBAAB
- Graft copplyment which contact consches derived from one monomer grafted onto the backhone derived from another monomer

AA	AAAAA	AAA	AAA.	A A
В	В			B
В	В			В
B	В			В
B	В			В
В	В			В

These structural differences extend the range of physical properties available to chemists for designing a copolymer It may be noted that nature in bler is real 4-pa propriete and has an essioninguistion about the double bond as shown below

All els configuration

There are weak you der Wools forces and therefore it is easter to be non-crystalline. However, as runs configuration has highly regular arginal channe which it ingether well. The 'illine's configuration occurs anount by as guifa percha, which is highly crystalline and non-clastic because of packing of chains. Extended channe of the graph and guifa percha are shown below.

Vulcanization of Rullier

Natural subber becomes soft and stocky when heated at high temperatures 5935K and brittle or ow temperatures < 288 K) It shows high water</p> absorption expanse. It is soluble in non-polar solvents and is non-realetan, to awack by exidesing agenua. It is not hard and tough. The properties of natural rubber can be monthed and improved by the process of villagmention. To improve as properties, it is bested with support at a temperature of \$73 to 415 K. The process of healing natural rubber with sulphur to improve its properties is called vulcanization. The vulcanization process performed right his was sow. Nowodays, some additives such as zinr oxide, etc. are used to accelerate the rate of vulcanization. During vulcanization, sulphur cross ankaon formed Fig.3. The formation of cross miks makes rubber and tough with greater tensile strength. The vulcanized rubber has excellent stasticity low wher asorption tendency resistance to exidetalit and organic solver is. The Julius bonus in the rubber molecule act as reactive sites. The allyhou CH., alpha to double bond is also very reactive. During vulcanization is alphar forms cross-unks either at their reactive anyur sites or at the sites of the double bonds. Fig 3. As a result, rubber gets suffered and intermolection movement of rubber springs is prevenied resulting in physical character of rubber. The extent of stiffness of vulcanized rubber depends upon the amount of sulphur added. For example, about 5% sulphur is used for making tyre rubber while 80% of sulphur is used for making battery case rubber.

In vulcanized rubber the chains are normally tangled up with each other Fig. 4. σ_B . When the rubber is stretched, the chains straighten one of some extent. Fig. 4. (b). The chains cannot step past each other because of the polysulphide bridges. Thus, rubber can be stretched only to a limited extent. When the tension is removed, the chains try to coil up again and the rubber resumes its original shape.

CH₃

CH₄ C→CH→CH₅

\$ 8

CH→C→CH→CH→CH₅

CH₃

CH₄

CH₅

CH₆

CH₆

CH₇

CH₇

CH₈

CH₈

CH C = CH CH₇

CH₈

CH C = CH CH₇

CH₈

Fig. 3. Sulphur cross links in valcanized rubber

Highly ruleanized cubber one siming earge amount 30-40%) of sulphur is called abounce

It is hard, relatively inclastic rubber used for combin buttons electrical insulation etc.

The comparison of the main properties of natural rubber and vulcanized

Vatural rubber	Valcamzed rubber
tamperature (from 10°C to 60°C). 5 It has now wear and tear resistance.	Vulcanized rubber is hard and non-sticky It has high elasticity strength It has high elasticity It can be used over a wide range of temperature - 40°C to 100°C; It has high wear and tear resistance It is insoluble in all the common sulvents
carbon tetrachloride, petrol etc	It is directly at an ple telephone because

B. SYNTHETIC RUBBERS

The synchetic nubber is any vulcanisable rubber ake polymer which is capable of getting stretched to about twice of its length. However, it returns ... its original shape and size as soon as the external stretching force is reiensed. It is obtained by polymerizing certain organic compounds which may have properties sum ar to rubber and some additional describe properties. Miniof these polymers are derived from butadiene derivatives and contain carboncarbon double bonds. These are also vulcainsed by processes developed for natural rubber. Therefore, the symbeth rubbers are either hom of symposiof. 1 S-butadiene or co-polymers in which one if the monomer is 1 3-but a neighor its derivative so that the polymer has the availability of double bonds for its videnmention.

Some common examples of synthetic rubbers are neoper to, styrene butadiene rubber ${}_{*}SBR_{h}$ thickol, allicones, polyurethane rubber, etc.

L Neoprene Rubber

It is prepared by free midical proymensation of chiomomene (2-chlorobists-1 Saltene.

The starting proteins, chromorene subtorned by dimensation of aretylene by passing it it rough equeous so also of NH₂Cl and cuprous chorde at \$43K followed by treatment with HCL

$$2HC = CH \xrightarrow{Ca_{1}Cl_{0}, \ HH_{0}Cl} \xrightarrow{HC} HC = C-CH = CH_{2}$$

$$\xrightarrow{Yuy! \ acetylens} HC! \xrightarrow{HC!} CH_{2} = C \cdot CH = CH_{2}$$

$$\xrightarrow{Markovnikov} \#ruse \xrightarrow{CH_{2}} C \cdot CH = CH_{2}$$

Uses: Neoprene a superior to natural nubber in its stability in semal unidation and teresistance a vegetable and immeral oils, gasoline and wher solvenia. It is used as instantor, making conveyor belos, gaskets, hoses and printing rollers.

2. Styrene Butadiene Rubber (SBR or Buna-S

1. is obtained by the polymerisation of nata-1, 3-diene and styrene in the ratio of 3 1 in the presence of sodium.

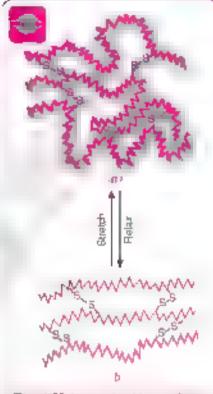


Fig. 4. Vulcanuad rubber and effect of stretching

In Bune -S. Ph. stands for butadiens. on for sodium and S for styreus

$$\label{eq:charge_entropy} \begin{split} nCH_2 &= CH - CH = CH_2 + n & \xrightarrow{\partial n \text{diam}} \\ \text{Butz-1, S-diane} & \text{Styrene} \\ \hline \\ & CH_2 - CH = CH - CH_2 - CH_2 \\ \hline \\ & DEB \\ \end{split}$$

It is also called Buna-S, in which Bu stands for but adiene for for sodium and S stands for styrens. It has sightly less termine strength that natural rubber

Uses: It is used for making automobile tyres. It is also used for making floor tales, footwear components, cable manistron, etc.

8. Nitrale rubber or Buns-N

It is obtained by potymeries and of buts 1. 3-diene and acrylomizate in the presence of a permide catalyst.

$$nCH_2 = CH - CH = CH_2 + CH_3 = CH$$

$$Buta-1. 3 thene CN$$
Accyloratrile

It is also called Bunn-N. It is resistant to the action of petrol, submenting oil and organic solvents.

Users By user for making to see a manufacture of hoses, and anings etc.

MOLECULAR MASSES OF POLYMERS

A polymer sample commune chains of varying lengths and therefore, its noter for mass as a ways expressed as an average. On the other hand, natura, polymers such as proteins contain chains of dentical length and, therefore, they have definite molecular mass.

The molecular mass of a polymer can be expressed in two ways

(i) Number average molecular mass (MN

If N=N $_2$, N $_3$ —are the number of molecules with incircular masses M $_1$ M $_2$ M $_{\rm grid}$, respectively, then the number average molecular mass is

$$\mathbf{M}_{N} = \frac{\mathbf{N}_{\underline{a}}\mathbf{M}_{\underline{a}} + \mathbf{N}_{\underline{a}}\mathbf{M}_{\underline{a}} + \mathbf{N}_{\underline{a}}\mathbf{M}_{\underline{a}} + }{\mathbf{N}_{\underline{a}} + \mathbf{N}_{\underline{a}} + \mathbf{N}_{\underline{a}}}$$

Thus may be expressed as

$$M^{m} = \frac{\sum M}{\sum N^{c}M}$$

where N_i is the number of molecules of the ith type with molecular mass M_i .

(d) Weight average molecular mass $(\overline{\mathbf{M}}\mathbf{w}$

If $m_{\pi}, m_{\pi}, n_{\pi}$, are the masses of species with molecular masses M_1, M_{π}, M_{π} respectively then the weight average molecular mass is

$$= \frac{m_1M_1 + m_2M_2 + m_2M_3}{m_1 - m_2 - m_2}$$

The setter 'N' on Bune-N stands for acrylumbrile.

$$m_{\star} = \frac{\sum m_{\star}M}{\sum m_{\star}}$$

But $m_{\star} = N_{\star}M_{\star}$ so that $M_{\star} = \frac{\sum N_{\star}M^{2}}{\sum N_{\star}M}$

where N_i is the number of molecules of mass M_i

Polydispersity index

The ratio of mass average moterniar mass to the number average malecutar mass is called polydispersity index, PDL.

$$PDI = \frac{\overline{M}_{w}}{\overline{M}_{h}}$$

This gives an idea about the homogeneity of a polymer

i) The polymers whose molecules have nearly same molecular masses are called monochaperse polymers. For these caolecules $M_{\star}=M_{\star}$ and therefore, PDI is one.

 σ . The polymers whose nodecudes have underrange of a oten for masser are called polydisperse polymers. For these polymers, $M_w > M_w$ and the σ fire, their PDI is greater than one.

Thus, it may be could used haven general natural polymers are more homogeneous than synthetic polymers.

For natural polymers, PDI is usually unity and therefore, natural polymers are monodisperse.

For symmetric polymers, the PDI is greater than time and merefore, $\mathbf{M}_{\mathbf{g}}$ is always greater than $\overline{\mathbf{M}}_{\mathbf{g}}$. $\overline{\mathbf{M}}_{\mathbf{g}}$ is a ways determined by emproying methods which depend upon the number of molecules present to the polymer sample. For example, or lightly emprety such as against the present is used. On the other hand, weight average molecular mass is measured by using the methods such as agait scattering and differential governor, recomentation, etc. which depend upon the mass of individual molecules.

BUTTO AND STREET, STREET, SERVICE.

■ Example 3...

In a program sample 30% who, we have a molecular mass 20,000-46% have molecular mass, 30,000 m of the rest have 60,000. Calculate mass invertige and number average molecular masses.

Solution The polymer contama 30% molecules of mass 20,000, 40% molecules of moleculer mass 60,000 and rest 30% of molecules of moleculer mass 60,000. Thus,

$$\begin{array}{lll} \overline{M}_{\text{H}} & = & \frac{\sum N_{\text{t}} \underline{M}_{\text{t}}}{\sum N_{\text{t}}} \\ & = & \frac{30 \times 20000^{\circ} + 40 \times 30000 + 30 \times 60000^{\circ}}{90 + 40 + 30} = \text{asuco.} \\ M_{\text{H}} & = & \frac{\sum N_{\text{t}} \underline{M}_{\text{t}}}{\sum N_{\text{t}} \underline{M}_{\text{t}}} \\ & = & \frac{30 \times 200000^{\circ} + 40 (300000)^{\circ} + 30 (600000)^{\circ}}{30 \times 200000 + 40 \times 300000 + 30 \times 60000} = 43330. \end{array}$$

BIODEGRADABLE POLYMERS

The polymers are finding extensive use in our day to day life. However, a large number of polymers are quite resistant to the environmental degradation process and are therefore, responsible for the accumulation is of solymers solid waste materials. These solid wastes cause ocute environmental problems and remain undegraded for quite a long time. With the increasing use of polymers, the problem of disposal of waste of these products in also posing serious problem. The main option is to produce budgeradable polymers which can be broken down rapidly by soil incre-organisms and therefore, it introduces may serious effects on the environment. Thus,

biodegradable polymers are the polymers which are degraded by micro-organisms within a suitable period so that biodegradable polymers and their degraded products do not cause any serious affects on the environment.

In biological systems, biopolymers degrade mainly by enzymatic hydrolysis and to some extent by oxidation. Therefore in view of the disposal problems of polymer waste and for leveloping polymers for other safe uses in buman system, attempts have been made a develop biodegradable symbetic polymers. These symbetic polymers are finishly have functional groups which are normally present in biopolymers and lipids.

Among these days, the properties are one majoritant class of biodegradable polymers which are commercially potential biomaterials. The common examples of biodegradable polymers are polyhydroxy butyrate. PHB , polyhydroxy bi tyrate-co-β-hydroxy valerate (PHBV), polyglycolic acid. PGA), polyhettis acid (PLA), pr. y. e-cap-blacton. PCL: etc. These are briefly discussed below.

1. Poly-t-hydroxybutyrate-co-f-hydroxy valerate (PHBV)

It is copolymer of 3 hydroxybutanoic acid and 3-hydroxypentanoic acid, in which the monomer units are joined by ester inkages

The properties of PHBV vary according to the ratio of both the acida 8-Hydroxy butanon and provides stiffness while 3-hydroxypen anon and gives flexibility to the copolymer. It is used in speciality packaging inchopaedic levices and in controlled release of thigs. When a drug is enclosed in a rapeule of PHBV—this released into when the polymer is degraded in the body. It also undergoes bacterial degradation in the environment.

2. Polyglycolic acid (PGA

Polyglycone and PGA is obtained by the chain polymerisation of cyclic dimer of glycohe and, HO—CH, COOH.

$$n$$
 HO— $\mathrm{CH_2COOM}$ $\overset{\mathrm{Hort}}{\longrightarrow}$ \rightarrow — $\mathrm{OCH_2C}\overset{-}{\longrightarrow}_{\overline{n}}$ Glyenlic acid $\overset{\mathrm{Polyglycolic}}{\longrightarrow}$ geid $\overset{\mathrm{Polyglycolic}}{\longrightarrow}$

3. Polylactic acid (PLA)

Polylactic acid. PLAr is obtained by polymerisation of the cyclic dimer of lactic scid. How CHr. $H_3 = OOH$ or by microbiological synthesis of lactic scid followed by the poly-condensation; and removal of water by evaporation.

4 Poly (e-enprolactorie) (PCL)

Poly te-enprolactione PGL is obtained by chain polymenastics of the lactone of 6-bydroxy hexancic acid.

6. Nylon-2-Nylon-0

It is a polyamide copolymer of glycone NH_a. CH_a—COCH and amino caproic and (NH_a—(CH_a)_cCOOH). It is also biodegradable

All these are polyenters and are therefore at reepable towards hydrolysis of their ester links. Cupulymers of PGA and PLA have found a wide range of uses. A ropolymer of PtA and PLA 90–10 is used to make absorbable suitures to close an internal or external wound and has replaced catgut. These are completely degraded and absorbed by the long within 5 days to one noith of the surgery Polyhydroxybutyrate. PHF and possivelroxy butyrate-co-\(\beta\)-invarioxy on erote tPHBV have occurated for making fame for packaging and in a monaded items.

Biodegradable polymers are used mainly for medical goods such as surgical sutures, tissue in growth instern is or for controlled drug release devices it asima substitutes etc. The broudposition resistance as ally involve hydrogens either enzymatically induced or by non-enzymatic mechanisms to non-toxic amali molecules which can be metabolized by or excreted from the body. These are also finding use in agriculture materials (such as films, seed costings) fast food wrappers, personal hygiene products etc.

POLYMERS OF COMMERCIAL IMPORTANCE

Besides, the polymers there are many other commercially important compounds already discusse. Some of these alongwith their structures and uses are noted in Table 1.

Table 1. Some other commerceally important compounds.

Name of polymer	Monomera	Structure	Important uses
րսիձնասիջաթ	(`H ₅ 4')H=(`H ₉ Propens	CH, CH,	for parking of tectries and foods if for manufacturing overs of bug liming material for TV cabinets as refrigentiars, (a) for making ropes, fibros, heat shrinkal araps for recards and other articles. (a) for making automobile mountaings, as covers, carpet fibres, etc.
Polystyrene	CH = CH ₁	[сн,_сн],	 (i) for making hot drank caps, toys, must have who, d articles, etc. (i) for making radio and television body refragerator analys. ne no associate propping moteria. (iv) for making tiles to be used in covere cenage and floors.
Polyvtay) eliionde (FVC)	CH.—CH—Cl Vinyl chlorida	(ci)	() in the manufacture of rum cools, has bogs, curtain clothes, toys, (ii) in artificial flooring, (o as a good assisting maleria is the and other electrical goods (c) for making gramophone records
Polymethyl metanorylete PMMA	CFI _p C COOL FI _p CH _q Methyl methodylata	Chy a coonty [used in the manufacture of least ranspurent duties and sky git dentures, ascentil anadous and protect rost ags (a) Its communical names are Lucki Plengham, Acrylite and Persper.
l reg formaldehyde regin	Nh ₂ -ONH ₂ Urea H 1 Formuldehydo	TNH CO NH—CH ₂₇	For making unoreneasie cups, plates, a landaled sheets
Glyptei	HOCH, CH, OH Bthylade plycol COOH COOH Phthylic and	-оон,-сн _° оос	For manufacture of paints and largue For manufacture of building material
Thinkol or polyamphide rubbore	CICH_CH_CI Bibylene duidonde . Na_S_ Sodum satzasulplade	+CH _y CH _y S— Thankon	S. S. S. † three low cancile strengto but beth resistance to abranon and solven and are therefixe, used at tyre are contings

SOLVED EXAMPLES

Example 4...

Identify attphatic brodegradable polyester which is used in packaging and orthopodic devices

- (i) Write its full form.
- Fu, Give the structures of monamers from which is a formed
- (iii) Show the formation of polymer

Sciution: It is PHBV

- Poly β-hydroxybutyrate-co-β-hydroxyvalerate
- cH_a—CH(OH)CH_aCOOH and
 c'H_a—c'H_c a'H_C H_C (H_cOOH)

 $a \rightarrow$

Practice Droblems

- Arrange the following polymers at increasing order of intermotecular forces. Also classify them as addition and condensation putymers.

 Nylon-6. neopreps. PVC
- Classify the following polymers as client growth and step growth polymers
 Bune-8 Nylon-d6 Tecyleus to PVC
- 3. Fril in the blanks

Manamera

Putymara

One unportant use

Glyptali

for making crockery

Arkput and, hexamethylene dismine

601

for making ewitches and pings

0)

PMAA

Answers to Practice Problems

- 1 Neoprece. PVC hytot-6 Neoprece and PVC Addition polymers Nylon-8 condensation polymer
- Tiene growth polymers are and a
- 8. (f) Ethylene glycol phthahe
 actd, manufacture of points.
 lacquers
 Memmis. formuldenyde
 meiomine forma dehyde
 resin
 Nyion-65 for making car
 - pets and textile fibres

 Phenol. formaldehyde
 baketos
 - Methylnerylnce for making ionses



C

O

Ν

C

E

P

Т

U

А

Conceptual Questions

- Q.1. What is the primary structural feature necessary for a molecule to make it useful in a condensation polymerisation reaction? (A.L.S.B. 2016, Assum S.B. 2015)
- Ans. The measurers must be beforetioned as symbols two functioned groups
- Q.3. What are cross-linked polymers? Give one example of this type.
- Ans. The polymers is which the inner polymer chains are cross linked to form a three-dimensional network structure are called "ross" inked polymers. The common example of this type of polymer is bakelite.
- Q.S. What is the difference between two notations bylam-6 and bylam-86?
- Ans. Nyton-6 is obtained from expedientian which is obtained from cycloherance. It has only one compound having only 6-cerbon arous.

Ny-en-86 refers to polymer obtained from 6-carbon atoms of disarboxylic acid (adapt: acid) and 6-carbon atoms of disarbox became the became the disarbox of the carbon atoms of the carbon

- Q.4. Are proteins natural or synthetic polymers?
- Ans. Proteins are natural polymera.
- Q.5. Name one polymer formed by step growth polymerisation. Give names of its monomers.
- Ans. Nylon-66 Its monomers are
 - Adapte seid HOOC (CH_{9/4}COOH
 - Hexamethylenediamine NH, NH, aNH,

- Q.6. What is the trade name of polyacrylonstrile?
- Ans. Orlon or acriton
- Q.7 How do thermoplastic differ from thermosetting polymers?
- Ans. Thermoplestics when heated become soft. These can be mouded into any desired shape. The thermoplestics can be processed again and again.
 - On the other band, thermosetting phostics on beginning became next and misorable masses. These cannot be moulded into desired shape and cannot be reprocessed.
- Q.8. Arrange the following polymers in increasing order of their intermolecular forces. Also classify them as addition and confensation polymers:

Nylon-66, Bana-S. Polythene.

Ans. Polythena < Bunn-8 < Nylon-66

Nylon-96 Condensation polymer Bons-S Addition polymer

Polythene Addition polymer

- Q.9. What is the function of S in the vulcanization of rubber?
- Ans. Sulphus makes the rubber more clastic, more ductale, less plastic and non-stacky
- Q.10. Name a polymer which is used for making non-stack utennia.

(Pb. S.R. 2013)

- Ans. Teflon.
- Q.11. Is +CH₂—CH₃C₃H₃H₄ a homopolymer or a copolymer? Is it on addition polymer or a condensation polymer?

 [V,C,E,R,T]
- Ans. It is a homopolymer and its monomer is styrene. C_cH_c : $H = CH_c$. Since the monomer contains a double bond, it forms an addition polymer.
- Q.13. Explain the difference between polyacrylates and polyesters.
- Ans. Polyacrylates are formed from the esters of scrybe and "H_a = CHCOOH such as CH_a = CHCOOR For example, polymethyl methascrylate (PMMA)

Polyesters are polymers having ester linkagus (C) (O) > For example, ter

+O−CH₂CH₂O CO CO These are condensation polymers

- Q.15. Write the structure of a reagent used for initiating a free radical chain reactions. How does it not?
- Ans. Tertakry intyl nervede is used for in tinting a free radical chain reaction. It decomposes under mild contains to form 6-butoside free radical which autraces the reaction.

Q.14. Write the monomore and chemical equation for the preparation of Buna-S rubber.

Ph.S.B. 2008)

D.S.D. 2006)

Q.15. On the basic of forces between their molecules in a polymer to which class does nylon-66 belong?

Ans. It belongs to the class of fibres

- Q. 16. Arrange the following polymers in the increasing order of tensile strength.
 Nylon 6, Buna-S, Polythene.
 (CBSE Sample Paper 2010)
- Ans. Bring S < Polythene < Nylon 6

Q. 17 Is
$$\left\{\begin{array}{c} CH_{2} \\ CI \end{array}\right\}_{n}$$
 a homopolymer or a copolymer?

Ans. Homopolymer

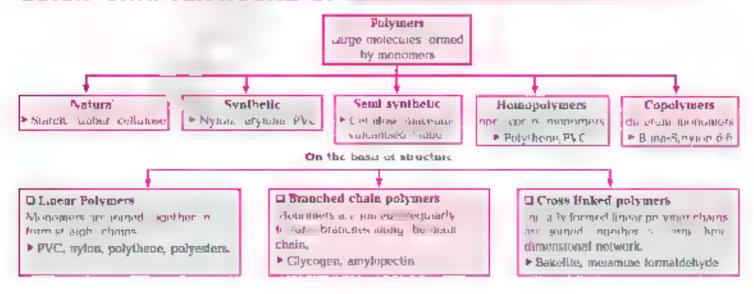
ALS.B. 2019)



Key Ierms & Laws

- Polymers are ligh motecular mass substances whose molecules consist of repeating series of monomers.
- Homopolymers. Polymers whose repeating structural and is derived any from one ope of monomer units e.g. polythene.
 PvC polypropytene neoprene, nylon-fi
- Copolymers. The polymers whose repeating structural unit is derived from two or more monomer units e.g. Nylon-66.
 Binne-S. dekebte polyesters.
 - Addition polymers. The polymers formed by direct addition of a large another of improvers are called addition polymers.
 - ⇒ Condensation polymers. The polymers formed by the codensation of two or more than two monomers by the lose of H_nD_c HCl etc.
- Natural polymers: The polymers obtained from nature, plants and animous e.g., starch, collubes, natural rubber, proteins, etc.
- Synthetic polymers. The polymers which are propored by many in aborntones e.g., polyethy end hydron arise, very tene.
 LeBon, PVC, etc.
- Semisynthetic polymers. The polymers which are derived runs naturally occurring polymers by chemical modifications.
 e.g., calculate notate, celluloss introte, etc.
- Elastomers. The polymers in which the interminerals forces between polymer chains are weakest and have elastic character.
- Fibers. The polymera which have strong internotection forces between polymer chains
- Thermopiastics. The pulymers in which his increase are intermediate between those if elastamers and fibers.
 In these polymers, there is order-unking between the chains.
- Thermosetting polymers. Low molecular mass semifluid substances which when heased in a mould indergo change in chemical composition to give a hard, infusible and insoluble mass.
- Valendisation. It is a process of leeting ribber with 3-5% surphur to increase its properties such as censile strength, classicity and rematance to abrasion.

QUICK CHAPTER ROUND UP



On the basis of intermolecular forces

O Blabomers

Rubber life, souds with easilie properties having weakest entermolecular forces.

Buna-S, Buna-N, Neoprens

☐ Fibres

Thread forming schids possessing bigb tenallo strong/b and high mode us. These have strong intermolecular forces tice hydrogen bonds

► Nylon 6,6: terylene

Thermopiastics

Have intermolecular forces between hose of classomers. and fibres. Hard at room temperature, become soft and viscous on beating.

Polythene, polysiytene. ethou

☐ Thermoselting

Cross daked and beavily branched which on beaving undergo permanen) change by extensive cross linking ebluca ai

baketite, urea-tormatdebyde

On the basis of mode of synthesis

Add tion polymers

Formed by addition of monomors without elimination of water

Buus-S. polyethylene

Condensation polymers

Pormed by combination of monomers with elimination of water atochol, CO_o, atc.

Nyton 6, 6, bakette

• fo terms of intermolecular forces hermoselling > Thormoplastic > Fibrus > Plasfomers

Na ira rights as a proymer if support 2-mothyths as 3-dipoly Bus inspired supreme having any militar supremembers he double hand







NCERT

In-text Questions 📙



Q.1. What are polymers?

- Ane. Polymers are high molecular mass substances formed by the combination of a large number of ample molecules They are also called macromolecules. For example, polythene, bakelite, etc.
- Q.2. How are polymers classified on the basis of structure of polymers?
- Area. On the basis of structure of polymers, these are classified.
 - Linear polymers s.g., polythens, nylms, polyvinyl rhlomde etc
 - (41) Branched chain polymers e.g. Inw density polythens. glycogen
 - .mi) Gress linked polymers e.g., bakel.ce, makumine, etc. For details refer Text Page 3-41.
- Q.S. Write the names of monomers of the following polymers.

$$\begin{split} & \vec{r} = \begin{bmatrix} \mathbf{H} & \mathbf{H} & \mathbf{O} & \mathbf{O} \\ \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{O} & \mathbf{O} \\ \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{O} \\ \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \end{bmatrix}_{\mathbf{I}} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \end{bmatrix}_{\mathbf{I}} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \end{bmatrix}_{\mathbf{I}} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} & \mathbf{I} \\ & \mathbf{I} \\ & \mathbf{I} & \mathbf{I} \\ $

Ans. Monomers of polymers

- (c) Hexamethylena diamine and adipic said.
- (6) Caprolactam
- so: Tetrafluornethene
- Q.4. Classify the following as addition and condensation. polymersi

Terylene, bakelite, polyvinyl obloride, polythene

Ann. Terylene

Condensation polymer

Balketria

Condensation polymer

Polyvinyl chlorida † Addition polymer

Polythene

Addition polymer

- Q.5. Explain the differences between Buna-N and Buna-S.
- Ann. Burna-N is a conclyment of Butta-1, 3-diene and convlouitrile. Buos-S is a impolymer of buits 1, 3-diene and styrene
- Q.tk. Arrange the following polymers in increasing order. of their intermolecular forces:

Polythena,

(d) Nylum-6, 6, Buxta-8,

Polythene

10 Nylon-6. Neoprene, Polyvinyl chioride

Nyton 6. 6

Ann. (r) Buna-S. (ii) Neoprana,

Polyvinyl chloride,

Nylon-6



Q.1. Explain the terms polymer and monomer-

Ans. Polymer as a high molecular mass macromolecule formed by the combination of a large number of emple molecules. Monomer as a simple molecule expable of undergoing polymerastics to form polymers.

For example, polythene is a polymer and its simple molecule athere is a monomer

nCH₀ = CH₀ Polymertusium [—CH₀ -CH₀—]₀
Monanuer Polymert

Q.2. What are natural and synthetic polymers? Give two examples of each type.

Ans. Natural polymers are high molecular mass macromolecules obtained from natural sources plants and animals. For example.

e Proteins (ii) Nucleic acide

Synthetic polymers are man made high molecular mass macromolecules which are prepared in laboratories. For examine

J Polythene (& Nylon

Q.3. Distinguish between the terms homopolymer and copolymer and given an example of each.

Ann. Homopolymer is a high molecular mass more molecular pulymer) which is formed from one type of minimers. For example, polythene is a homopolymer because it is formed from ethene monomer. Copolymer is a high molecular mass macromolecule or polymer which is formed from two or more different managers. For example, nylin it is a copolymer formed form hexamethylene diamine and edipic acid.

nH₂N aCH_{min} NH₂ + nHOOC (CH₃ COOH₃) He table to the followine Amond and Physicians NH₃ + CH_{min} NH₃ + CH_{min}

Nylma-6, 0 copolymen

Q.4. How do you explain the functionality of a monomer?

 $\mathbf{Ans.}$ Functionality is the number of bonding wies in a monomer

Q.5. Define the term polymerisation.

Ans. Polymerischen is a process of formation of high molecular mass pulymer from one or more monumers by linking together of repeating structural units with covarent bonds.

Q.6. In (NH-CHR-CO), a homopolymer or copolymer?

Ann. Refer Solved Example 1. (Page 8)

Q.7. In which classes, the polymers are classified on the basis of molecular forces?

Ans. On the basis of molecular forces present between the chains of various polymers, these are classified as

(i) Eleatomere e.g., natural rubber buna-S

ω) Fibres e.g. daeron, nylon-6 6

(ini) Thermoplastics s.g., polythene, tellon

(co) Thermosetting s.g. bakelite, melamine. For details refer Tex. (Page 4).

Textbook Exercises

Q.S. How can you differentiate between addition and condensation polymerisation?

Ans. In addition polymerisation, the molecules of same or different monomers combine to form a large polymer without the elimination of some other molecules.

In condensation polymerisation, the molecules of two or more infunctional monumers undergo a series of condensation resolutes with the elimination of emple molecules water, ammonia, alcohol, etc.,. For details refer Text (Page 6)

Q.9. Explain the term copolymerication and give two examples

Ans. Copolymensation in a process in which two or more monomers combine to form a polymer. The copolymers contrain a multiple units of each monomer in the chain Examples. () 1, 3-butadiene and acrylometric.

in 1, 3-botathene and styrene

Q.10. Write the free radical mechanism for the polymerisation of ethens.

Ann. Refer Test (Page 6,

Q.11 Define thermoplastics and thermosetting polymers with two examples of each.

Ann. Thermophatica are the polymers which can be easily softened repeatedly on heating and hardened on cooling. Therefore, it can be used again and again. For example

a Polythene , a Polyvmyl chioride

Thermosetting polymers are those which undergo permanent change on besting. They become hard and infusible on beating and cannot be softened again. For example,

Bakelite

(ii) Melamine formaldehyde.

Q.12. Write the monomers used for getting the following polymers:

(i) Polyvinyl objeride

(iii) Teflon.

(iii Bakelite

Ans. , O Polyvinyl chloride OH₂ = CHOl vinyl chloride

 μ) Teffon $CP_0 = CP_0$ tetrafluoroethene

ea) Bakelite | CaHaOH | phenol) and HCHO (formaldebyde

Q.13. Write the name and structure of one of the common mitrators used in free radical addition polymerisation.

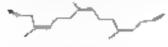
Ans. Bensoyl peruside C.H. C.O.O.C.H.

Q.14. How does the presence of double bonds in rubber molecules influence their structure and reactivity?

Ans. Natural rubber is a linear cir-1, 4-polysoprese in which double bonds are present between C_2 and C_5 of isoprese insta. The cir configuration about double bonds does not show the chains to come closer for effortive intermolecular.

attraction due to weak intermolecular attractions. Therefore, the natural rubber has coiled structure and shows elasticity and is non-crystalline.

On the other hand, eli trans configurations occur in guide-percha which is trans polyscoprene. These zig-zag chains peck more closely in gutta-percha and hence it is highly crystalline and non-electric and is more hard and brittle than rubber



National number all are configuration

Putta-percha all trans configuration

- Q.15. Discuss the main purpose of vulcanization of rubber.
- Ann. Refer Text (Page 14
- Q.16. What are the manameric repeating units of nylon-8 and nylon-66?
- Ans. Nylon 6 $[NH-(CH_0)_3-CO]_n$ Caprolactom Nylon 6, 6 $[NH-(CH_{2'6}]]$ NH $-CO-(CH_{2'4}CO)_n$ derived from besamethylene diamine and adapte acid.
- Q.17. Write the names and structures of the monomers of the following polymers:
 - i) Bunn-8
- of) Bann-N
- iii) Deccon
- ir) Neoprene.
- Ams. . Buna-S
- . 3-Butadiens (H,=OH=OH=OH=OH
- Styrene
- T(i)=H2/2H⁰D
- BunneN 1 5-Butadiene 'H,=CH-CH= H.
 - Accylon bale CH,=CH N
- Duction Ethylene gyrol (H_g -(H_g
 - ÓH 0...

- . Neoprene Chloroprene CH₂= C-OH=CH₃
- Q.18. Identify the monomer in the following polymer structure:

Ans. (i) HOOC—(CH_{9/8}COOH Detention and NH₈—(CH₉)₆—NH₈ Hexamethylenediamine

- Q.19. How is damon obtained from ethylene glycol and terrobthalic acid?
- Ans. Darron as obtained by the polymerisation of sthylene gives and seryphthalic and

ברי בל הינות אינה

- Q.20. What is a bindegradable polymer? Give an example of a bindegradable alighatic polyester.
- Ans. The polymers which are degraded by micro-organisms within a suitable period at that the polymers and their degraded products donot cause any serious effects on the environment are called biodegradable polymers. For example.

Poly B-bydroxy butyrate-co-β-bydroxyvalerate PHBV).

NCER NCER

Obserting Questions from Exemp

Objective Questions from Exampler Problems are given a Competition Free, page 48

>>> -

--- Short finauer Type Questions ----- 4

 A natural linear polymer of 2 methyl 1.
 3-butadiene becomes hard on treatment with sulphur between 378 to 416 K and -8-8- bonds are formed between chains. Write the structure

Exemplar Problems



Subjective Questions

of the product of this treatment.

Ans.
$$CH_2 = C + CH + CH_2$$

 CH_3

Polymoprene natural rubbers When it is asseted with S at 873-413 K, it results into -S-S- unks forming

This is called vulcanisation of rubber

2. Identify the type of polymer.

-A-A-A-A-A-A-A-

Ann. Home pulymer

8. Identify the type of polymer.

Ann. Copolymer.

4. Out of chain growth polymerication and step growth polymerication, in which type will you place the following? →A→_n + →A→_n → →A→_m→A→_n or →A→A→_{n+n}

And. Chem prowth polymeraston.

Identify the type of polymer given in the following figure.

Ans. Cross-linked polymerasation

6. Identify the polymer given below t

Ans. Polyisoprene or natural rubber

7. Why are rubbers called clastomers?

Ans. When force is applied, rubbers are stretched and these regain origins, at at eather the force is removed. Therefore these are called elastomers.

8. Can enzyme be caded a polymer?

Ana. Enzymes are brocate yets which are proteins and are thus polymers.

 Can nucleic acids, proteins and starch be considered as step growth polymers?

Ans. Yes, step growth polymers are condensation polymers and they are formed by the loss of simple molecule like water leading to the formation of high molecular mass polymers.

10. How is the following resin intermediate prepared and which polymer is formed by this monomer unit?

Ans. The starting materials for this intermediate are melamine and formaldehyde. Its polymerication gives melamine polymer.

.1. To have practical applications why are cross links required in rubber?

Ans. The cross-links make the subber hard, tough with greater censile strength. The vulnamed subber has excellent clustricity low water absorption tendency, resistance to oxidation and organic solvents.

12. Why does our polylsoprens possess elastic property?

Ans. In cis-configuration of polynoproue, there are week van der Warls frees and therefore, it is elastic

13. What is the structural difference between HDP and LDP? How does the structure account for different behaviour and nature, hence the use of a polymer?

Ans. LDP consists of highly branched chain molecules. Due to branching, the molecules do not pack well and therefore, at her low density (0.92 g cm⁻⁸) and low melting point LDP is transparent of moderate tensile strength and high toughness. It is chemically mert

HIIP consists of linear chains and increfive the dialectries can closely pack in space. Therefore it use high density .0.97 g cm⁻³) and high melting point. It is quite hard, tougher and has greater tensile strength than LDP

.4. What is the role of benzoyl percuide in addition polymerisation of alkenes? Explain its mode of action with the help of an example.

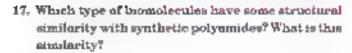
Ans. Benzoyl peroxide acts as an initiator in free radiosiaddition polymerication of alkenes by providing chain initiation.

The radical formed adds to the carbon-carbon doubte bould of an atkene molecule to form a new free radical

The new free radical adds to a double bond of monomer to form a larger free radical which adds to another alkane molecules and ultimately forms the polymer

- .5. Which factor imparts crystalline nature to a polymer like nylon?
- Ans. Strong intermolecular forces such as hydrogen bonding words to close pocking of chains. This imports orgataline nature to polymer such as mylon.
 - .6. Name the polymers used in laminated sheets and give the name of monomeric units involved in the formation.
- Ann. The polymer is area formaldebyde resin

Monomera Urea NH.,CONH., Primakidebyda HCHO



Ans. Proteins Polyanudes and proteins contain sunde ankages

- 18. Why should the monomers used in addition polymerisation through free radical pathway be very pure?
- Ans. Pure monomers are required because even the traces of impurities may set as initiators which leads to the formation of polymers of anall chain tengths





MEMORY TEST



🔼 Say True or False

- 1. Caprolaction is a monomer of cylin 8, d.
- Bunn-S is an example of electroners.
- 8. Bakelite is an example of thermoplastic
- 4. PDI is used to determine the homogeneity of polymers
- Ethylene glycol and phthalic soid are monumers of glyptal.
- 6. Polythene is a copolymer
- FVC, dacron, bakelite and polystyrene are examples of synthetic polymers.
- 8. Nylon has the weakest intermolecular forces of attraction
- 9. Teflan is used for making nonstick utanails.
- Bakelite, meiemine formsidebyde and buns-S are examples of thermosetting polymers.

Complete the missing links

- 2. Buna-S is copolymer of and
- 8. The process of vulcamzetion was introduced by
- Nylon 6 is obtained by polymerisation of
- 5. The polymer used for making non stock atensils is
- 6. Natural rubber is a polymer of
- The trade name of polyscrylomitrile is
- 8- The theremorething polymor whose one menomer is phenoical.
- 9. Terylene is a polymer of and

- 10. Formaldebyde is one of the managers of and
- 11. The monomers of nylon-2-nylon-6 are and
- 12. PHBV as brodegradable polymer and its monomers are
- 13. In Bone-S. S stends for
- 1d. Dem-butytphtharate is a
- 16. Neoprene is a polymer of

6. Choose the correct alternative

- Destron is a polyamidal polyestar polymer which is widely used as a suture
- In aylon, intermalecular forces of attraction are hydrogen bandinglidipals-dipole interactions
- 8. PHBV is a hintegradublemen biologradable polymer
- 4. Suna-S is a homopotymer/copolymer
- The monomers of bakelite are formaldehyde and phenoli ethylene glycot
- 6. 4 NH CHR CO 1, is a homopolymericopolymer
- 7. Nylon-6-sa a udditron polymer/condensation polymer.
- Vulcanized rubber is obtained by beating natural rubber with nodium/surphyr
- Buna-N and Buna-S are examples of elastroneral thermophasics.
- 10. Polythene is thermoplestic! hermosetting polymer





MEMORY TEST



A. Cay True or Faine

- 1 False
- 2. True
- 3. Palse. Bakelite is thermosetting polymer
- True.
- 5. True
- 6. Folse
- 7. True
- B. Palee. It has strongest feroes of attraction.
- O. True
- 10. False

B. Complete the missing links...

- 1 nyton 8 8
- L buta- : 3-diene, styrene
- 3. Charles Goodyear
- 4. capecinctem
- 6. teflou
- 6. moprene

- 7. orbin or scribin
- 8. bakel re
- 0. sthylene glycol terephthalic acid
- 10. bakehte, melemme formeldehyde resm.
- 11. glycine, summo exprote cent
- S-bydroxybutannie acud, 3-bydroxypentamour acut.
- 18. styrene
- 14. plaaticizer
- chloroprene

Chaosa the carrent alternative

- 1. polyester
- 3. brodegradable
- 4. copolymer
- 5. phenol
 - madementson
- 7, condensation 9. classumers
- 6. homopolymer

2. hydrogen bonding

- 8. sulphur
- 10. thermoplastic



Higher Order Thinking Sk...Is



QUESTIONS WITH ANSWERS

Q.1. Why should one always use purest monomer in free radical polymerisation centrion?

Ans. In free radical polymerisation reaction, the imparities can set as chain transfer agent and may combine with the free radical to slow down the reaction or even stop the reactions.

Q.8. Will you prefer to polymerise narylanistile under amonic or entionic conditions. Explain.

Ans. Acrylomitrile ($\mathrm{OH_0} - \mathrm{CH-CN}$) contains an electron withdrawing (- CN) group which can stabilise the current intermediate. Since in amonic purymerization, carbanium intermediates are produced, therefore, polymerization of acrylomitrile must be carried on under amonic conditions

Q.5. Could a co-polymer be formed in both addition and condensation or not? Explain with examples.

Ann. Co-polymers can be formed both by addition and condensation polymerization. For example, styrene

butachens rubber is a co-polymer which is obtained by addition polymerization while hylon-60 is a copolymer obtained by condensation polymerization

Q.4. What is the monomer of

Q.5. Arrange the following allienes towards order of increasing reactivity in cationic polymerization.

$$H_3C=CHCH_3$$
, $CICB=CH_3$, $H_3C=CHC_6H_6$, $H_4C=CHCOOCH_6$

Ans. Reactivity of an alkene towards estimate polymerization increases as the stability of the intermediate earlocation formed increases. Since the stability of the carbocation increases in the order

therefore, the reactivity of the corresponding alkene towards causing polymerization increases in the same order as

$$H_aC = CHCOOCH_a < CH_a = CHC_1 < CH_a = CHCH_a < CH_b = CHC_bH_a$$

Q.6. Arrange the following alkenes to order of increasing reactivity towards anionic polymerization.

Ans. Reactivity of alkene towards amonic polymerization increases as the stability of the intermediate carbamon increases. The stability of the carbanion increases as

(where B is any base or a mucleophile.

Therefore, the reactivity of the corresponding alkene bowards amonic polymerization increases σ the same order

$$CH_2 = CHCH_2 < CH_2 = CH = CH_3 < CH_2 = CH_3 =$$

Q.7. Poly (butylene terephthulate) is a plastic material used in automotive ignition systems and has the formula:

- (i) Suggest the monomers which might be used to synthesise this polymer-
- (ii) What type of polymer is it?
- (iii) Is this an addition polymer or condensation polymer?
- vie: Write the resotion.

And, a The monomers are

Lel-butanedial

- . It is a polyester
- 241 Condensation polymer
- annaHoch, ch, ch, ch, ch, ch +

Q.8. Arrange the following groups of monomers in order of decreasing about to undergo cationic polymerization:

Ans. Reactivity of an alkene towards not any polymerization increases with increase in stability of the intermediate carbocation Therefore, decreasing urder of estionic polymerization is

Q.9. Propose a free radical mechanism of polymerization of isoprene.

Ano. Toopeono is a monomer of natural rubbor. The free raction mechanism may be depicted as

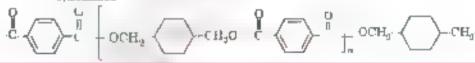
Chain mitiation Instator
$$\uparrow$$
 \dot{R} radical
$$\dot{R} + \dot{C}H_2 = \dot{C}CH = \dot{C}H_2 \quad , R = \dot{H}, \quad \dot{C} = \dot{H} = \dot{H},$$
 $\dot{C}H_3 = \dot{C}H_3

Chain propagation

Chain (ermination

R
$$CH_2$$
 $C = CH$ CH_2 CH_3 $C = CH$ CH_3 $C = CH$ CH_3 $C = CH$ CH_4 $C = CH$ CH_5 CH

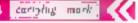
Q.10. Kodel polyester is formed by trans-esterification of dimethyl terephtholete with 1,4-di (hydroxymethyl) cyclohexane. Write its resotion.





Revision Exercises

Voru Short Reswer Constinue



- Write the RPAC name of the monomer of natural rubber
- Explain the term addition-polymeriantum with an example Hr S B 2017
- 8. What are plasticizers? Give one stroupte. Pb.S.B. 2006.
- 4. Write the name of one copplymer (Pb.S.B. 2011)
- 5. What is the name of polynor which is also known as order? HPSB 2012
- What are intelegradable polymers? Give anample
 D.S.B. 9011 Hr. S.B. 2014, 2017
- 7. In nylon 6,6, what does the designation '6, 6' mean?
- D.S.B. 2011 8. What are the monomeric units of hylon-6, 6?
- HPSR ONT PASR WITH
- Write the numerous of bakehts (Pb S B. 2012, 2013)
 Define the term homopolymerisation giving an example.
- (D S B. 2012
- 11 Write the monomers of decron. (HPS.B 2013
- Explain the term on-polymerization with example "Hr S H. 2014, 2017
- What are non-biodegradable polymers? Give example J K S.B 2013

- 14. Write two examples of synthetic polymers
- Uttarakhand S B 2014)

 15. Write the name and structure of the monomers of Bune-S Pb.S B 2014)
- 10. Write the name and structure of the monomers of Buse-N. Pb.S B 2014)
- 17 Write the name and the structure of monomer of polystyrene Po.S.B. 2016)
- Write the name and the structure of monomer of polyvinyl channels Pb.S B 20.67
- What is the cross linked polymer obtained by the polymerssion of phenoland formaldelivite? Kernin S.B. 20.8)

CBSE QUESTIONS ----

- What is the primary structural feature necessary for a molecule to make it suchil in a condensation polymerisation reaction?
 A.1 S.B. 2010)
- 21. Is (CH₁—CH) a homopolymer or a copolymer?
 (A.I.S.E. **0.3,
- 22. Give one example of a condensation polymer

A. S.B. 20.3

23. Which of the following is a natural polymer?

Bone-S, Proteins, PVC A.I.S.B. 1901s

- 24. Based on molecular forces what type of polymer is neoprene? A.J.S.B 2014
- Which of the following is a fibre?
 Nylon, Neoprene, PVC
 A.I.S.B. 2014)

MI Os From State Boards Examinations

- 26. Polystyrens is a o) oddytym polymer
- (b) thermmoleshe polymer
- e both a and 61
- none of these Hr S.B. 2015
- 27 Cellulose is a o) anteral polymer
- (4) semi-synthetic polymer
- c synthetic polymer none of these
 - Hr S.B. 2015

- 28. Buna Sisa (a) addition polymer a both a and b'
- condensation polymer (d₁,
- mone of these (42)
 - Hr S B. 9013

- 90. Battefroe m a (a) addition polymer
- b) thermoplastic polymer
- (c slastomer polymer (d) thermusetting polymer Hr S B. 9013
- 30. Which of the following is called a pulyamide? (b) Nylon
 - (a) Revon (c) Terviene
- (a) Bakelita of K.S.B 2013
- Which is a condensation polymer?
 - a PVC b) Tellon (c) Bakebte .d) None of these
 - Hr S B 2014
- 32. Bakelite is a product of the reaction between.
 - (a) Formaldehyda and NaOH
 - Anume and Urea (6)
 - Pheno) and Markenol s reli
 - Phenol and Formaldehyde tď.

J K S.B 2014

- 39. Valenciention makes rubber
 - to agone elusion ed delenancements subsena) none of these
 - (c) erystalline

- H P S.R. 2016
- Neoprene te a polymer of
 - (a) Chlomprene
- b) Liggrens
- (c) Styrene
- d) Ethene

Hr S.B. 9010

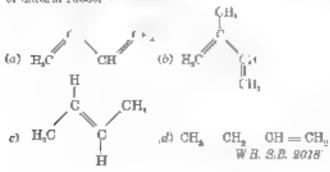
- The monomer and of PVC as
 - (a) yinyl chlorida
- b) ethylene
- (c) chloroprene
- a) acrylomitrite

H.P.S.B 30170

- Which of the following is not applicable to Nylon-6, 6 ?
 - (a) Synthetic polymer (c) Addition polymer
- 6) films .d) Condensation polymer
- 37. In the following thermosetting polymer is
 - a Bakeute
- o Fulvinene
- (c) Polyester
- (d) Buns M (Hr S.B. 9018)
- 38. Monomer of tellon is
 - (a) $CF_2 = CF_2$ $CH_3 = CF_3$
- $G_1 \circ CH_- = CH \circ N$

Hr S.B. 9018

39. Which of the following can be considered as the monomer of natural rubber?



Sport flower Quadlage corrying for I marks

- Define the following terms and give one example for each
 - Synthetic polymers
- (ii) Natural pulymers
- wii) Condensation polymers .iv) Thermosetingpolymers
 - Additaon polymera

Hr S.B. 2015)

- 2. Write the structure of monomer of each of the following नाशकर्याच्य
 - Polyvinyl chiomde
 - (i) Nylan-0

(D.S.B. 2007)

- What are copolymers? Give chemical equation for preparation of givetal.
 - b) What are electomers? Write chemical equation to represent the preparation of Buna-S. H.P.S.R. 2008).
- 4. Write the names and structures of the monumers of the following polymers
 - C Bome-S
- (#) Neoprega
- tti) Nykur-Ö

- (D.S.B. 2008, 2017).
- A. Draw the structures of the accorners of the following polymera
- (iii) Polyvinyl chloride (PVO).
 - Malamane-formaldehyda polymer

D.S.H. 9009, 9017)

- d. How will you prepare polymer darron? Give its chemical reaction. (Hr S.B. 2018)
 - Give the common and IUPAC name of the monomer. of nature, subber HPSB. 2010)
- How will you prepare polymer PAN, polyacry-ionitrale? Give its chemical reaction.
 - Give the name of the polymer which is used for making non-stack otensils. H P.S.B. 2010)
- 6. What is the repeating and in the condensation polymer obtained by combining HO, CCH, CH, COOH (succinc and) and H₀NCH₀CH₀NH₂ ethylens diamins)? (D.S.B 2010)
- Differentiate between molecular structures and behaviours. of thermopiastic and thermosetting polymers. Give one example of each type. (A.I.S.B 2010)
- 10. Mention two important uses of each of the following
 - (i) Bakelite
- ,μ) Nylon-**ö**.
- (D.S.B. 2011
- Name the subgroups arta which polymers are classified on. he bear of magnitude of intermolecular forces.

(D.S.B 2011

- 12. What is vulcamzation of rubber? What are the advantages of valcanized rabber 7. 'H.P.S.B. 2012, 2016;
- .3. What are polymera? What is the difference between barrapolymer and co-polymer? Give examples.

(HSPB 2012 Micorani SB 2017

- Name a polymer which is used as a substitute for wool 14. 0 What is as monomer wat?
 - b) What are natural and synthetic polymers? Gave one erample of each type.
 - Discuss the main purpose of vulcanission of rubber (Meghalaya S.B. 2010)
- 15. () What is vulcamention of rubber?
 - (4) What is the monomer of natural rubber?
 - (....) Define elastomer
- (H.P.S.B. 2018-

 D fferentiate between addition and condensation polymerization. Give two examples of each

Hr.S.B. 2018, 2017 Meghataya S.B. 2015,

- 17 a Name the monomers of baketice.
 - b What is the primary feature necessary for a monomer to make it useful in a condensation polymerization reaction?
 - (c What is meant by copolymerization? Give one example of a copolymer (Assam S.R. 2013)
- Write the names and structures of the monomers of the following polymers;
 - O Bune N
- (a) Neoprene
- (iiii) Daoroa.

(D.S.B. 2013, 2017)

- 19. (a) How is Nylon-8, 6 obtained? Give one of its uses
 - (b) What are biodegradable and non-biodegradable polymers? Give one example each.

Nagaland S.R. 9018)

What are addition polymers? Write the chemical equation for the preparation of synthetic rubber

Misoram S.B 2014

- (a) Give the common and IUPAC name of the monomer of natural rubber
 - b) How is high density posythene obtained? What structural difference it has from low density polythene?
 - (c) Name a copolymer which is used for making nonirreability plastic crockery?
 - (d) Write the names and give the structures of the monomers of Nylon-5.5. Meghalaya S.H. 2018
- 22 (a) Write any two differences between step growth polymenastion and chain growth polymenastion.
 - (b) What are the monomers of the following

i) Neoprene (ii) Nylon-6 Karala S.B. 2014)

- 28. (a What are copolymers? Give themics, equation for the preparation of glypus H B B B J B
 - by What are the monomers of baketice?

HB 8.B. 2018

- Explain the method to prepare aylon-5 and aylon-55 polymers
 H S i. 2018
- Polymers are uncoromolecules formed by the union of monomers
 - to. Name natural polymers and synthetic polymers.
 - b) Distinguish between thermoplestic and thermosetting polymers with example. Kernia S.B. 2015
- What is voicemention? Give two points of differences between nature, rubber and vancatured rubber

Misuran S.R. 2015

- 27. a) What are the monomer units of the polymer nylon-2nylon-6? Is this polymer bindegradable?
 - A What are elastomers? Live one example.

Megharaya S.B. 2013

- 28. a What is Buns-S? Give two uses of it
 - b What are biodegradable polymers? Give two examples. (Nagarand S.H. 2015.
- 30. a What are polymers?
 - Name the monomers of polythene, tellon and nylon-6.8

02

- What is vulcamention of rubber?
- b) What is the role of sulphor in vulcanisation of rubber? Associa S.B. 2015

80. (a Write difference between thermoprastic and bermusetting polymers

Hr S.B. 2018, H P S.B. 2018)

- Explain the difference between polymer Nylon-6,6 and Nylon-6 Hr S.B. 2018)
- c) Differentiate between the monomers of Bune-N and Bune-S (Hr. S.B. 2016)
- 81 Write the names and structures of the monomers of the following polymers.

(a) Nylon 6,6 (a, PHBV

- (n) Neoprene / ** (D.S.B. 2018
- 82. (c) Give synthesis of Bune-S

(f) What are fibres ?

- (iii) Give synthesis of Nylon-6, 6. (H.P.S.B. 2018)
- (a Write any three points of differences between addition and condensation polymers. (M.corom S.R. 2018)
 - b) Explain isodegradable polymers. (H.P.S.B. 2016)
- 84. How is nylon-66 obtained? (Nagaland S.B. 2016)
- 86. a Write the name and structure of monomers of (1 Bakehts / 12 Polythene
 - (i) What are biodegradable polymers?

Or

- Give one example each of
 Addition polymera
 - (a) Condensation polymers
 - Why is rubber videnmed? (Tripura S.B. 2016)
- Classify the following polymers into elastomers and fibres

Rubber Nylou-8.6. Buna-S. Terylene

- b What do you mean by thermosetting polymers? Give one example. (Kerola S.B. 2016)
- 97. " Name the monomers of , Buns-N and ... SBR
 - b What are low density and high density polyethylenss? Maghologia S.B. 2018)
- 88. a Explain the preparation of Nylon-5. 6 with equation.
 - b What are thermoplastic polymers? Give an example.
 - Write the structure of morphase (2-methyl-1.3 butadiene Karmulaka S.B. 20 8.
- 39. Write the monomers used for preparing the following polymers
 - i) Glyptal (n Nylon-6,6 (Hr S.B. 2017
- Write down differences between terylene fibres and Buna-S rubber elastomers). Ph.S.B. 2017;
- 41. a Give one example of addition homopolymer
 - 6 Mention one use each of LDF and HDF.
 - c. What is the monomer and of natural rubber?

Assom S.B. 20171

- 42. p What are addition and condensation polymers? Give an example of each type
 - Name the polymer which can be used as a substitute for wool

Or

- Write the equation for the synthesis of terylene from athylene glycor and terephthane and
- d' Define thermoplastics and thermoselting polymers with an example of each (Meghanaya S B. 2017)
- 43. a How can Buna-S be prepared ? Give one use of it.

 Or
 - b, What is LDPE and HDPE? (Nugatural S.R. 2017)

- 44. How is bakelite made and what is its major use? Why is bakelite a thermosetting polymer? Manipur S.B. 2017.
- 46. Differentiate between thermoplastics and thermosetting plastics. Write one example of each. (Kerola S.R. 2017)
- (i) Give one example of homopolymer and one example പ് രാ-സ്വാലം
 - Mention the structural difference between thermoplastic and thermosetting polymer
 - μα) Give one use of high density polythene (HDP)

Assam S.R. 2018,

47. What are biodogradable polymers "Give chemical equation. for the preparation of any one hindegradable polymer.

CBSE QUESTIONS

- 48. Differentiate between condensation and addition polymerication. Sive one example each of the restating polymers. A . S B 2009, 2010, Pb S B. 2017.
- 49. Differentiate between thermoplastics and thermosetting polymers. Give one example of each.

A.I.S.B 2012 Hr S.B. 2010.

50. Define thermopleatic and thermosetting polymer Give one ezample of each.

What in a brodegradable pulymer? Give an example of a modegradable abphable polyester.

51. Write the names and strutures of the monomers of the following polymers

 Notion 8 feer Huns-N

u Navalec

A.I.S.B. 9015

- (t) What is the role of t-butyl percende in the polymerisation. of ethene?
 - 4) Identify the monomers in the following polymer:
 - + NH (CH₂) NH CO (CH₂) CO+, an Arrange the following purposers in the increasing order of their intermolecular forces. Polyatyrene, Terytene, Buna-S

Write the mechanism of free radical polymerisation (D.S.B. 2016 4. S.B. 2016) of athene

- 68. Write the structures of the monumers used for getting the following polymers
 - a) Polyvnyl chloride PVC
 - n) Melamine-formaldehyde polymer
 - _ / A.I.S.B. 90:4, 9015, 9017) (ci) Buna-N ...
- 54. Write the structures of the monomers used for getting the following polymers
 - Tethra.
 - Melamine-formaldehyde polymer
 - A.I S.B. 2014, 2015, 2017) col Neoprens /
- 55. Write the structures of the monomers used for getting the following polymere
 - Ju Nylan-6,6
 - a Malamine-formaldehyde polymer
 - A.I S.B. 2014, 2015, 2017)
- 56. (a) Write one structural difference between low-density polythene and high-density polythene
 - (b) What is a biodegradable polymer? Give an example. A.I S.D. 2018

Hints & Answers

Revision Exercises

Lery Shart Inswer Onestians

- 2 Mathylbuta . S-diene 5. Polyacrylonitrile
- 8. Hexamethylenediamuse and adopte and
- 9. Phenol and formaldehyde
- 11 Ethylene glycol and terephthalic acid
- 16. Buta 1 3-diene and styrene

- Buta-1, 3-diene and acrylonitade.
 - Bakeute
 - 21. Homopolymer
 - 20. Proteins 24. Einsteiner 25. Nylon
 - 26. (6)
- 27 .6)
- 28, (a)
- 30. (4)

- 84. (a)
- 31 (g)
- 32, (4)
- 35. .01
- 86. (d)
- 33, 12 97. a

29. (1)

38. .a)

Competition File

Additional Jeeful Information and Objective Questions

ADDITIONAL USEFUL INFORMATION

A Vantil Polymerwation

Most of the commercial addition polymers are very polymers obtained from alkenes and their derivatives. " $H_{
m i}=$ CH. The polymerisation reaction involves the same steps

a) Chein mitiation step

$$\mathbf{I}_{\mathbf{n}}^{\star} \leftarrow \mathbf{C}\mathbf{H}_{\mathbf{n}} = \mathbf{C}\mathbf{H}$$



Vioy) ecopound

b Chain propagating step In
$$-CH_2$$
 $-CH_2$ $-CH_3$ $-CH_4$ $-CH_4$ $-CH_4$ $-CH_5$ $-CH_5$

Chain transfer agents—Competiting reactions in vinyl polymerization

It may be noted that in vinylor polymerisation, various other various of free radicals we also other compounds present may compete with the parent chair reactions. For example, the reaction may take place with molecules which can react with growing chain so interrupt the further growth of the original chair. However, the product of such a reaction may attact its own chair growth. This weeks to inversig of average resoccutar mass of the polymer. Such companies which bring away. The termination of the original physical chair with the summation of the original physical chair with the summation of another polymer chair, are called **chair transfer agents.** The common examples are carbon cetrachloride, our box tetrahomde, etc. For example, in the presence of carbon tetrahomde, styrane, $\operatorname{CH}_{\psi} = \operatorname{CH}_{\psi}$ polymerizes to

form a polymer of lower average molecular mass which also concerns some chimner.

In this polymerisation reaction, growing polystyrene radical which normally whold and on a polymer reacts with the chain transfer agent. CCL, to end the opened chain and form a new radical. The latter first radical autieus a new polymerature chain and

agent. CCl_s to end the original chain and form a new radical. The latter free radical instruces a new polymentation chain and forms a new polymentation chain and forms a new polymentation below.

It may be noted that if the chain transfer agent forms is radical which is highly reactive, the chain reactive gets terminated. Therefore, have compounds inhibit further polyments our and are now called unhibitors. Many analoss phenois, quinouse etc act as inhibitors. Therefore, even wares of certain impurities which can set as chain transfer agents or inhibitors can interfere with his original chain polymentation reaction. Hence, the monumers should be free from such inhibitors.

3. Cationic Polymenssion

When the abusing statum it adds to the norther bond to form a calcular intermediate for propagating the addition chans process. It is called **cationic addition polymerisation**, it is notisted by saids. The commonly used across for cationic polymerisation are sulphuric and H_0SO_4 . HF BF_3 in the presence of small amount of water

The chain reaction involves the following steps

(i) Chair initiation. The proton adds to the carbon-carbon double bond of alkenes to form a stable carbocation.

$$H + C_1 I_2 = C_1 I_3$$
 $\Rightarrow C_1 H_2 + C_2 H_3 + C_4 H_4 + C_4 H_5 = electron donating group.$

Vinyl remotilism

Carboputies

(if) Choto propagation. The carbocation adds to the carbon-carbon double bond of another monomer molecule to form a new carbocation, which can ammerly add to another molecule of alkene and so on resulting polymer.

$$CH_{3} - CH_{2} - CH_{2} - CH_{3} - CH_{2} - C$$

Chain termination. The chain reaction may be terminated by combination of carbocation with degative ion or by bas of a proton

The complete reaction may be written as:

$$H^* + H_2C = CH$$
 $\rightarrow H$ CH_2 CH $\xrightarrow{H_2C = CH}$ Repeat $\rightarrow CH_2 - CH \xrightarrow{h}$ G

It may be noted that and catalysed or callon polymerisation is effective may with viny, monomers which contains an electron donating group G. These electron donating groups will be able to stabilize the chain carrying carbocation intermediate. Greater the stability of the carbocation intermediate more lastices in cathonic polymerisation. Thus, alternic continuing electron releasing groups are preferably polymerised under cathonic conditions shough free radical polymerisation may also take place. For example, isobutylene polymerised under radionic conditions because it has two electron releasing. If H_2 groups that will stable so the intermediate cathon. However, othylene, vary! chloride or viny! cyanide, sorv!on.come. do not undergo polymerisation readily. For example, polymerisation of isobutylene is carried out-commercially etc. $M^{(p)}$ using K^p , and a small amount of water G generate K^p . Of H instalysts.

C. Antonic polymerastion

This type of polymemention is initiated by unions, which may be bases or other nucleophiles. The main characteristic step is uncleophile addition of an amount an inesturated informer. It proceeds through the formation of carbanion. The initiation may be prought about by reagents such as any indicate, or potential and e. K*NH₀. For example,

Chain propagation

It may be noted that amon catalysed polymerasation occurs in case of viny' monomers with electron withdrawing groups. X, Greater the statistics of the corbon on intermediate more factor is the unionic polymerisation. For example, alkenes containing electron withdrawing groups such as, acrylometrile, $CH_0 = CH_0N_0$ methy, methycrytate, $H_1C = CH_0 \cap H_0CUCH_0$), styrene $(H_1C = CHC_0H_0)$, etc. can polymerise animically.

The complete reaction with butyl lithron may be written as

Potymer

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions

A (108160015 MULTIPLE CHOICE QUESTIONS with only one correct answer

Polymers and their Classific, tions

- A3. Which of the following is unburnly occurring polymer?
 - a) Polythena
- b. Starch
- c) Nylon
- (d) Tellon.
- A2. Which of the following is not an example of addition polymer?
 - a Polyatyrena
- 5 Polyethylene
- (c) Polypropylene
- (d) Terylene
- A2. Natural rabber is
 - (d) neoprede
- b) truns-pulyieuprene
- (c) cra-polyisoprene
- (d) butyl rubber
- A4, Which of the following is not a biopolymer?
 - (d) Cellunes
- (b) Protesse
- ic) DNA
- (d) Nylon-6,6
- An. Which of the following is not a step growth polymer?
 - (a) Potybutadiena
- (b) Nylon-0,0
- (c) Glyptal
- (d) Terylene
- A0. Which of the following is a copolymer?

CH.

a CH C

cooch,

 $\delta' = CH_{\rm e} \cdot CH_{\rm e} \cdot \Gamma_{\rm g} H_{\rm p} + \frac{1}{2} H_{\rm p} + \frac$

- (c) +CH,CH=CH-CH,CH-CH, +
- 'S ←FH² —CH→"

 Cl

- A7. Polymer formation from monomers starts by
 - a mondenaes and reaction between monomers
 - b coordination reaction between monomers
 - or conversion of assumers to insummer son by proteins
 - a. Invitrative of monomers
- A8. Which of the following polymer contains nitrogen?
 - и Тегулган
- Nylon-8
- (e Bakeboe
- (d) Polyvinyl chloride
- A9. Which of the following is a thermosetting polymer?
 - na) Teflon
- (b) FVC
- (c Givotal
- .d) Bakehte
- A.O. Amongst the following, the strongest molecular forces are present in
 - (a) fibres
- (b) elastomers
- .c) thermosetting polymers d) thermoplestics

Some Important Polymers

- All. Neoprene to a polymer of
 - (p) obloroprens
- (6) chlorogain
- e propylene
- (d) выртепе
- A.2. The monomer unit of PVC is
 - ar varyl chronde
- b athylene
- (c) obligacionene
- (d) narylmitrde.
- A.M. Bakelste is the condensation polymer of
 - a) C_aH_aOH and caprolectum
 - b) HCHO and phthene acid
 - (c) C_nH_nOH and HCHO
 - d) HCHO and ethylene glycol.
- A14. Nylon-6, 6 is obtained from
 - .c) hazamethylene diamine and adipic and
 - ,6) phenoi and formaldehyde
 - ,c) propylone and adipte and
 - .d) adapte and and phthalic and

ACECONIA.

- A1 0 A2, d' A3, c A4, d' A5, a A6, c A7, o A8, b A9, d A10, c
- Ail (a) A.il (a) Ail (c) Ail (a

- A15. Bunn-S is obtained by the polymerization of but advene and
 - (a) chloroprene
- .b) styrene
- (c) acrylonitrile
- (d) adipte and
- A16. Caprolectum polymerases to give
 - a Nylon-0
- b Buna-S
- (c) Glyntrd
- (d) Teffon
- A17. Which of the following fibres is made of polyamides?
 - (a) Decrop
- (b) Orlin
- (e) Nylun
- (d) Rayou.
- A18. Orion to a polymer of
 - a) styrene
 - (b) vmyl chloride
 - ac acrylominie
 - (d) butadiene and adapre and
- A16. Which of the following is not a synthetic rubber?
 - (a) Neoprene
- (b) 6BR
- c) Thickel
- (d) Orlean
- A20. Interpartacle forces in nylon-66 are
 - (a) dipole-dipole interactions
 - (b) hydrugen banding
 - (c) van der Waal's forces
 - d'i some bonde.
- A21. $F_aC = CF_a$ is a monomer of
 - (a) glypini
- (6) Jeffmi
- e) orion
- (d) bunn-S
- A22. Tarylene is a polymer of ethylene given and
 - (a) phthalic oxid
- (6) terephthalir scirl
- (a) adipte and
- (d) 1.6-beredienme
- A20. Which of the following is not a biodegradable polymer?
 - (a) PHBV
- PGA
- (e) PMMA
- (d) PCL
- A24. Which of the following statement is not correct regarding vinyle polymerization.?
 - (a) It involves free radical addition.
 - (b) The presence of carbon tetraculoride in atyrene polymeneation results in lowering of average molecular mean of the polymer

- The presence of beazoquinous increases the polymentation process
- d) The presence of CCL, acts as subdutte
- A35. The monomers of terylene are
 - (a) phenol and formaldehyde.
 - b ethylene glycol and phthalic and
 - e adopte and and becamethylenediamore
 - (d) ethylene glyoor and terephthelic acid

- (a) Methyl methacrylata (b) Styrene
- c Propylene
- d' Ethene
- A27 Which if the following has eater ankage?
 - Nylon
- b) Bakel @
- (c Terylena
- d) PVC
- w Rubber
- A25. Which of the following is not correctly matched ?

$$σ$$
 Neoprene
$$\begin{bmatrix} CH_n \cdot C = v^*H_n \cdot CH_n \end{bmatrix}_n$$

- b Nylon-aid NH-CH, NH CO-CH, C
- d PMMA CH, CH, C
- A39. Poly-β-hydroxybusyrate. *D-6-hydroxyvalerate is no example of
 - .c) thermophustics
- b) naturally occurring polymer
- e biodegradaule polymer d) synthetic rubber
- A30. A polymen of prop-2-mentality a called
 - (o) dacerno
- (b) sarun
- (c) orlon.
- (d) polypropens
- A15. (c) A.6. (c) A17 (c) A18. A18. (c) A20. (d) A21 (d) A22. (d) A23. (e) A24. (e) A26. (e) A26. (e) A26. (e)

B MULTIPLE CHOICE QUESTIONS from competitive Examinations

AIPMT & Other State Boards' Medical Entrance

- B1. {NHICH, /aCONHOO(CH_{0/4}CO)₋ are
 - a, addition polymer
- (b) thermosetting polymer
- c) homopolymer
- (d) co-polymer

IC B S E. Med. 2000.

- B2. Which one of the following polymer is prepared by condensation polymerisation?
 - a Tellen.
- sto Raubber
- c Styrene
- d) Nylon-6,6

(C.B.S.E. Med. 2007)

- B8. Which one of the following statements is not true?
 - (a Natural rubber has the trans-configuration at every double bond
 - b) Buna-S as a copolymer of butadiene and styrene
 - c) Natural rubber is n 1, 4-polymer of isoprene
 - (d) Invulcanization the formation of sulphur bridges between different change make rubber harder and stronger

CBSE PMT 2008

- B4. Structure of some common polymers are given. Which one is not correctly presented?
 - a Neoprede CH₀ C = CH CH₂ CH₂ + CI
 - h Terylene OC COOCH, CH, O
 - (c) Nylon 6,8 -NH(CH_{2/6} NHCO(CH_{1/4} -CO-
 - (d) Tellon +CF₂ ·CF₂+
- ·CBSEPMT 2009
- B6. Which of the following statements is false?
 - (a. Artificial silk is derived from cellulose.
 - b) Nylon-66 is an example of elastomer
 - c) The repeat unit in natural rubber is isoprene
 - d) Both starch and rellmase are polymers of glucose

A. PMT 2012

- B6. Nylon is on example of
 - (a) Polyamada
- (b) Polytheon
- c Polyester
- d Proyearchende

NEET 2015

B7 Which is the minimum of neogrees in the following?

- (b) CH = CH C = CH
- c CH_-CH-CH-CH_
- Ø CH,—C⊢CH—CH₃ ČH,

OVEET 9013

B8. Which one of the following is an example of thermoetting polymer?

A FRACT OUTAL

- B9. Which of the following organic compounds polymerizes to form the polyester determ?
 - (a) Propylene and pare $HO-(C_gH_g)-OH$
 - 5' Benzoic and and ethanol.
 - .c) Terephchalic acid and ethylene glycol
- B10. Caprolactam is used for the manufacture of
 - or Templeme
- 5 Nylon 8.6
- e Nylon B
- (d) Tellon
- (AIPMT 2018)
- B11. Biodegradable polymer which can be produced from glycine and animosaproic and is
 - e)bana N
- 6) nylon 6,6
- (c) nylon Z nylon fi
- d) PHBV
- A.PMT 2016)

- B12. Natural rubber has
 - .e) alternate cis- and troza-configuration
 - b random ris- and from -configuration
 - (c) all cis-configuration
 - d'air trans-configuration.

NEET 2010)

B1. d B1. d B3. a B4. a B5. b B6. a B7 a B8 db B0. c B10. c

- H18. Which one of the following structures represents uplon 0,0 polymer?

 - NH, ČI / a Cre ca All All
- B14. Regarding cross-linked or network polymers, which of the following statement is incorrect?
 - to They contain covalent bonds between various linear polymer chams
 - (b) They are formed from bi- and kni-functional monomers.
 - (c) Examples are bakelite and melanina
 - td They contain strong covalent bonds in their polymer AEET 200 BY сбелль
- B15. Which of the following is not correct regarding larylane?
 - (a Step-growth polymer .b) Synthetic fibre
 - (c) Condensation polymer (d) also called decron
 - Korala P.M.T 300M (e) Thermosetting plantin
- BIG. Plessginee is a commercial name of

 - a glyptai
 - polyserylanitrile
 - polymethy, methodryinte
 - d) polyethylacrylate 6A.1 I M S. 2007
- B17 The polymer used in orthopaedic devices and in controlled drug release in
 - (a) Orlon.
- (b) PIFE
- (c) SBR
- / (d' PHBV
- tel PVC

- Kerato P M T 2009
- B16. Which of the following statement is not correct?
 - Cognilectars at the monomer of nylon-6
 - b) Terylene is a polyester polymer
 - Phenoi formaidehyde resin is known as bakelite.
 - of The monomer of anyther, rubber is but ediene.

DPMT 2010.

- B19. Which one of the following is an example of biodegradable polyeuter?
 - (a) PHBV
- .b) PET
- .e) Nylon 6
- (d) Bakelite
- e) Glyptal

- Kamlo P.M.T. 2014)
- H20. The polymer used in the manufacture of squeeze bottles is
 - a polystyrene
- (8) tellou
- (a) polymopene.
- d) high departy polythene
- .e) row density polythene.
- Kerata P.M.T 2015)

JEE (Main) & Other State Boards' Engineering Entrance

- Bk1. Which of the following is a polyamide?
 - onflett (o.
- the Nyton-6.6
- (d) Bakentz (A.I.E.R.R. 2005).
- B22. Which of the following is a fully fluorinated polymer?
 - (a) Neoprene / (c) Thinkal
- (b) Tellon
- (d) PVC
- (A I E.E E 2000)
- ROM. Bakelite is obtained from phenol by reacting with
 - (a) HCHO
- (b) (CH₂OH₂
- (c) CH_CHO
- (d) CH,COCH,
 - ALERE MOS
- B24. The polymer contaming strong inter molecular forces e.g. bydrugen bonding is
 - a Palyatyrona
- Neture rubber
- sc) Teffon.
- (d) Nylon 6. 5 (ALEEE 3010)
- B25. Thermosetting polymer bakeliters formed by the reaction of phenol with
 - (a) CH,CHO
- (b) HCHO
- (c) HCOOH
- d) CH₂CH₂CHO ALEEE OLD
- B26. The species which can serve as an initiator for the estitude polymerization ia
 - a) HNO.
- (b) A.Cl.
- (c) Bula

- d) LaAlH, (A.I E.E.E 2012)
- B27. Which one is elsewhed as a condensation polymer?
 - (c) Acrylomtrile
- Darami
- (c) Neopreoa
- (d) Tellun JEE Main 2014)
- B28. Which polymer is used in the manufacture of prunts and lacquers7
 - .e.) Polypropena
- (b) Polyvinyl chloride
- c Bakelite
- (d) Glyptal JEE Main 2018)
- H29. Which of the following statement about low density polythene is false?
 - .c) lie synthesis requires high pressure
 - b It is a poor conductor of electricity.
 - Па вудовени георигев диахурен ил и регонде инtrater
 - d It is used in the manufacture of buckets, dustbins etc.

JEE Main 20,6)

B.5. (a) B20. (e) B21. (b) B18. (c) B17. .d) R02 (b) B18. (d) B14 d) Bis. (d) B.9. (a) B23, p B24, d) B25, (b) F126. 6 B27 5 B28, (d) B39. .dh

- B30. The formation of which of the following polymers involves available reaction?
 - ta Nylon û
- b Bakelite
- (c) Nylna 6.6
- ut) Terylene (JEE Main 2017)
- B81. Match not I with list II and select the correct answer using the codes given below

List I (Polymers)

List II Monomers)

- 1 Buss-N
- A. Phthaiss and and ethylene glycol
- : Nylon-06
- B. Tereptuhalic acid and athylene glycol
- Dacron
- C. Hexamethylene diamore and adapte
- 4. Glyptal plastic D Isobutylene and isoprene
 - E Arrylomtrile and butadiene
- (a 1-B, 2-A, 3-D, 4-E
- (b) 1-C, 2-D, 3-A, 4-B
- c a-D, 2-C 3-B, 4-A
- a 1/E 3/C, 8/A, 4/B
- e) I-B, 2-C, 5-B, 4-A
- (Kerota C E.T 2007
- B82. Given the polymers
 - $A=Nylon\,\theta,\,\theta;\,B=Buns-S;\,C=Polythene.$ Arrange these in decreasing order of their intermolecular forces
 - e AsBsC
- 5 BaraA
- ter B « C « A
- (d) C < A < B D.C.E B009
- B35. Natural polymer amongst the following is
 - പ്രം Cലിപ്രമേ
- (b) Mode.
- c) Nylon
- (d) Tecylene

(Orașio J.E.E 2010)

- B94. In bakelete, the rungs are printed to each other through
 - QH
- ,d) C-

_A.M.U Engg. 3010

- B85. Which one of the following is an automple of co-polymer?
 - а Вида-Б
- (b) Teflon
- c) FVC
- (d) Polypropylene

West Benga. J.E.E. 2010

- B36. Which one of the following us a co-polymer formed by condensation polymerisation?
 - a) Terylena
- (a) Buna-S
- .c) Buna-N
- __d) Neoprene (J K.C E.T 2011
- B17. The morument used for preparation of nylos-2-nylon-6 m/are (a), exprelectant
 - bit alanua and amuso capture and
 - c) glymne and annuo caprac acid

- d) becamethylenediamine and adipic and
- (e) glycane and smino valeric acid (Kerola P E T 2011)
- B38. Monomera of bakehie are
 - a) phenol and formaldehyde
 - (b) pheuol and aretaldellyde
 - (c) quinol and formaldehyde
 - d) none of the above

(Oduște J E.E. 2011

- BSQ. In Buna-S, the symbol 'Bo' stands for
 - a) 1-butens /
- (b) st-butone
- (c) 2-butene
- d butadiene

Kamataka CET 9018

- B40. The repeating unit present in Nylon 6 is
 - a) -{NH(OH,)₀NHOO(CH₂,CO)}
 - (b) -{COCCH_2, NH}-
 - c COCH, NH
 - $d) = \{CO(CH)_{g,q}NH\}$
 - (e) {NH(CH_{a, N}HCO(CH_{b,4}CO)- (Kerula P E T 2013)
- B41. Novoloc, the linear polymer used in paints is
 - a) copolymer of bute- 4, 8-diene and styrene
 - b obtained by the polymerization of methyl methocrylate
 - (p) united product obtained in the condensation of phenol and formaldebyde in the presence of arid catalyst
 - d' obtained by the polymerustion of caprolectein.
 - eopolymer of molamens and fremoldabyde

Keralo P.E.T 20141

- B48. Terylene u not a
 - remylogue (a.
- b) polyeeter fibre
- e) chem growth polymer (d) step growth polymer

Karnataka CET 2014)

- B48. Identify the heteropolymer from the list given below
 - o) Polythane
- (a) Nylon-6
- (c) Teflon.
- .d) Nylon-6,6

MH-CET 2015)

- B44. Which among the following polymers door NOT soften on heating?
 - (a) Bakelite
- (b) Polythene
- (c) Polystyrens
- of PVC
- OMH-CET 2015:
- B45. Among cellulose, poly vinyl chioride), cylon and nature, rubber, the polymer to which intermolecular forces of attraction are weakest in
 - a) Nylon
- (b) Poly (vinyl chloride
- (c) Cellulose
- d) Naturel rubber

IIT JEE 2009)

- B46. Correct statement for thermoplastic polymer is:
 - a It does not become soft on heating under pressure
 - b It can not be remoulded
 - c. It is either linear or branched chain polymer
 - d It is cross-miked polymer
- MH CET 3010)
- B30. a B31. c Hg2 B85. c B26. a B27. c B88. .c. B20. d HR2. FCRdL o B40. (h) B41. (c) B42 (c) B48. d1 B44 (a) Bua. (d) Buth, fer

347 Bulletproof between are made from: (a Lexan	B68. Decron is continuous filement yarn used in ourtains dress fabrics and pressure fire hosse. The reaction for preparing decron in by the combination of which of the following? (a) Hermnethylene dumine and adopto and b Caprolaction (c) Phenol and formaldebyde (d) Ethylene glycal and templathalic axid
(c) Bune. S is a re-polymen of butene and styrene 1d' Natural rubber is 1, 4-polymen of isoprene. Karnatako CET 2016' 349. On complete bydrogeontian, natural rubber produces 10 ethylene-propylene copolymen 10 voltanused rubber (c) polypropylene 1d' polybutytene. 350. Which of the following is not a biodegradable polymen? (a Glyptal b) Polyhydranybutyrate-ou-\$ hydronyvalenete c) PHBV (d) Nylon-2-Nylon-6 (Karnataka C E.T 2017) 351 The monomera used in novolso, a polymen used in paints are a, butadiene and styrene b) butadiene and styrene b) butadiene and formaldehyde a) melainane and formaldehyde a) melainane and formaldehyde Karnataka C E T 2017 352. Protein is a polymen made of (a, carbobydratea (b) amino senis (c) nucleic acids (d) varbosylic acids (d) polycyclic aromatics (Keralo P E.T 2017)	B54. What is the IUPAC nomenclature of isoprens monomer present in natural rubber? (a) 2-Methyl-1, 3-untadiens (c) 2, 3-Dimethyl-1, 3-butadiens (d) 3-Methyl-1, 3-butadiens (d) 4-Methyl-1, 3-butadiens (e) 4-Methyl-1, 3-butadiens (f) 7-Methyl-1, 3-butadiens (g) 8-Methyl-1, 3-butadiens (g) 8-Methyl-1, 3-butadiens (g) 9-Methyl-1, 3-butadiens (g) 8-Methyl-1, 3-butadiens (g) 8-Methyl-1, 3-butadiens (g) 9-Methyl-1, 3-butadiens (g) 8-Methyl-1, 3-butadiens (g) 9-Methyl-1, 3-butadie
B47. a B48. b B49. a B60. a B61. c B67. (c) B58. (c)	B56. b B68. d B54. a B55. c B58. b
C. Which of the following are thermosetting polymers? a) Melamine b) Tellon c Polystvene c) Bakehta C2 Which of the following polymers contain 1 S-butadiene ns one of the monomers? a ABS plastic c) Shrim c) Shrim c) Shrim c) PMMA c, Terylene d) Bakehte C4. Which of the following contain ethylene glycol as one of the monomers?	a Melemma b' Polyetyrene (c) Glyptel (d) Terylene C5. Which of he following are biologradeble polymers? a PHBV b ABS plasme (c) PCL .d) PVC C8. Which of the following are condensation polymers? a Nylon-d b Styron c FEA d' Bakelite C7. Which of the following can be used as plasticians? a Gresyl phthalate (b) Diethyl phthalate (c) Polystyrene (d) Trimethyl phosphate C8. Which of the following statements are correct? a Albyl resins are addition polymers b) Polystyrene is a thermoplastic (c) Discron is a fibre (d) Natural rubber behaves as thermosetting polymer

Matrix Match Type Questions

Each question contains statements given in two columns. which have to be matched. Statements in Column I are inhelied. as A. B. C and D whereas statements in Column II are labelled. as p, q, r and s. Match the entries of Column I with appropriate entries of Column II. Each entry in Column I may have one or more than one correct option from Column II. The snawers to these questions have to be appropriately bubbled as illustrated in the following example

If the correct matches are A-v, A-v, B-p, B-s, C-v, C-s and D-q. then the correctly bubbled matrix will mak like the following

	р	q	r	8
A	(P)	(1)	0	(B)
В	(P)	(9)	0	(1)
C	(P)	(9)	0	(3)
D	(P)	(9)	①	₿

Match the chemical substances in column I with type of polymers/type of bonds to column H

Lamulo.)		Column II
A	Celluose	p nautrai polymer
∢B	Nylon 6,6	(g synthetic polymer
(0)	Protein	r muide unkage
D	Sucrose	's' glycomde ankage

Match the polymers in Column I with the characteristic geted in Column II.

Co	olumn [†]	Column II	
A_{i}	Вшив-Б	p. Synthetic polymer	
B)	Pakeute	g Emdegradatae polymer	
(C)	Tedion	(r) Electomer	
L,	asytmeter and	s Thermoplestic	

Integer Type Questions

Integer Type: The answer to each of the following question. is a single-digit-integer ranging from 0 to 9

- 1. The number of condensation polymers among the nylon 6, glyptal, orlon, tarylene, bakehte, PVC, nylon 6, 6, nielamme are
- How many of the following are synthetic rubbers? Bunn-S, polystyrene, Bunn-N (suprems, neighrene, thickof, PVC. terylene.

- 3. How many of the following are elastomers? Buna N aylon 6. Buna S. neoprene, natural rubber valesaized rubber acrilon, orlan-
- The number of thermoplastic polymers among tellon, polythene, PVC, polystyrene, bakelite, nylon 6, melamine formridehyde, PMMA are
- Number of synthetic polymers among PVC, nylou 6, starch. Buna-N terylene, bakelite, neoprene, polytaoprene, nylon 6. 6, glypkal, refuglase are
- 6. The total number of lone pairs of electrons in melanone is JRE Advance 2018

B. (1



NCERT

 Which of the following polymers of glucose is stored by annuali?

Exemplar Problems



Objective Questions

- Coltaiose
- Amylose
- Amylopectan
- Glyangen

- 2. Which of the following is not a semisynthetic polymer?
 - c) cis-polyisoprene
- (b. Cellulose mitrate
- (c) Cellulose scetate
- .d) Vulcanised rubber
- The commercial name of polynorylonitrile is:
 - a) Decroa
- (b) Orlow (acrilan)
- (e) PVC.
- d) Bakefete
- Which of the following polymer is biodegradable?
 - $c) + CH_{\bullet} \cdot C = CH + CH_{\bullet} +$

- +CH, CH = CH-CH, CH++
- 4N (CH.) N C (CH.).
- 5. In which of the following polymers ethylene glycol is one of die monamer ambe"
 - 400 H₂ 40H,000

 - (c) ←CH_c CH = CH—CH_c -CH - CH.-+-

- (4) +0-CH-CH2-C-O-C-CH4. C+2
- 6. Which of the following statements is not true about low density polythene?
 - a Fough
 - b) Hard
 - .c) Good conductor of electricity
 - (d) Highly branched structure

CH, / CH,

(CH₄ C CH₆ C 7, in a polymer having

CH, CH,

monomer units

- (a) = (a)
- (c) H>=<H (d) >=<
- 9. Which of the following polymer can be formed by using the following monamer unit?

- a) Nylon 6, 6
- (b) Nylon 2-nylon 8
- c) Melamine polymer (d) Nylon-6

4. (c) 8. (a) - Multiple Choice Questietts (Ti

In the following questions two a more options may be commen

- 9. Which of the following polymers, need stiesst one diene monomer for their preparation?
 - a Daeron
- b, Buna-S
- energoeN (a.
- (d) Novotac
- 16. Which of the fallatwag are characteristics of thermoselting: potymers?
 - (a Heavily branched cross united polymers.
 - b) Linear alightly branched long chain molecules.
 - .c.) Become infusible on moulding so cannot be reused.
 - d) Soften on heating and harden on rooting can be reneed.
- - 9. (h), (e) 10. (u, (e) 11. a., d)
- 19. (c). (d)
- 18. (c), (d)
- 14. fu. d

- 13. Which of the following polymers are thermophesic?
 - a Teffon

8. (d'

7. (a

- b Nation subber
- to Neoprene a Polystyreae 12. Which of the following polymers are used as fibre?
 - a) Polytetrefluoroethane (b) Polychioroprene
- - (c) Nylon
- (d) Terylene
- 18, Which of the following are addition polymers?
 - a) Nylon
 - b, Melanune formaideliyde rean
 - (c) Orlon

 - Polystyrene
- 14. Which of the following polymers are condensation polymers?
 - .c) Brikelite
 - sh. Telloo
 - (c) Butyl rubber
 - d) Melamme formaldebyde resin

- 15. Which of the following monomers form biodegradable potymers?
 - 3-hydroxybuamour acid + 3-hydroxypentanour acid.
 - 6) Glycine + amino caproic scid.
 - c) Ethylene glycol + phthalic acad
 - d) Caprolactum
- .6. Which of the following are example of synthetic rubber?
 - a. Polychioroprese
- (b Polyacrylomitri)e
- c) Bussa-N
- (d) cie-polyteoprene



- 10. 0 6
- 16. 4. 4
- 18.0 b d
- all at of





Match the stems of Column I and Column II in fatioienne anestrons

20. Match the polymer of column I with correct monomer of

Culumn I	Column II
(a) High density pulythene (b) Neoprese (c) Natural rubbar (f) Tellon	(i) Isoprene (ii) Tetrafluoroethene (iii) Chioroprene (iii) Accylomatrile
(e) Acrilan	to Ethene

21. Match the polymers given in Column I with their chemical names given in Column II

Column I	Column II
a Nylan 6	Polyviny-chiomsto
b, FVC	(n) Polyaerylonitrile
e Armien	e Polyespeciaet am
a Natural rubber .e) LDP	(v) cis-polyisoprene

20. Match the polymers given to Column I with their commercial nomes given in Column II

	Column I	Col	чтл П
fa	Polyestar of glycol and	(1)	Navulac
	phobalic acid		
.bs	Copolymer of 1 8-butadiene	(#)	Glyptai
	and styrens		
.c	Phenol and formaldehyde regin	(441)	Bunn-S
(d)	Polyester of glycol and terephthabe seed	(48)	Buns-N
165	Copulymer of a 0-butadiens and	(0)	Вистиц
	nerylamanle		

(c) Rubber d) Polyesters 18. Which of the following polymers have vinyle monomer ands? a) Aerilan (b) Polyebyrene

(b) Polyetyrene

17. Which of the following polymers can have strong intermo-

- (d) Tellon (e) Nyton
- 19. Vulcanisation makes rubber
 - (a) more electro-

lecular forces

a) Nylon

- b, soluble in morgaine solvent
- (c) crystalline
- of more auti
- 20. Match the polymers given in Column I with their main applications given to Column II

	Column I	Column II	
Lil	Baketos	(r) Unbreakable crockery	
ь	Low driver y polythene	-al Non-stack cookwares	
L	Melanane-firsts	ur, Psekagung material for shock absorbance	
do	Nylon 6	(p) Electrical systches	
0)	Polytstrafluoroethans	v) Equeeze bottlee	
41	Pulyatyrend	(or) Tyre, cords	

24. Match the polymers given in Column I with the preferred mode of polymerantion followed by their managers

Column I	Сопин П
a Nylon-8-8	Pree rodical polymensación
5. PVC	Ziegler-Notte polymemention or
	coordination polymerisation
r HTP	Antonic polymensation
	.iv) Condensation polymerisation

35. Match the polymers given in Cohumn I with the type of linkage present in them given in Column Π

	Column I	Column II	
(0)	Terylane	6)	Glymsidic linkage
6)	Nyton	(11)	Ester linkage
(c)	Cellabas	(2.0)	Phosphodiester linkage
.d)	Protein	(20)	Annde ankage
(4)	RNA		

- 20, a)-aug by (ing (c) +); (d) -(ii); g) -(io)
- 22. a prb . r c > d' c · e .
- 24. (a) = (ack 6 + Ac (c) + 12

- 21 a b c and che e
- 23. (a) (a) k (b) (b) . (c) (f) . (d) (of), (e) (of), (f) (ia
- **25.** (a) \Rightarrow (ii); b' \Rightarrow (iv); c) \Rightarrow (iv); d) \Rightarrow (iii) \Rightarrow (iii) \Rightarrow (iii)

28. Match materials given in Column I with the polymers given 0 %) wan II

Column 1	Column II
a. Natural rubber late	es (a Nylon
b, Wood aummates	a Neoprette
(c. Ropes and fibres	(azi) Daceron.
call Poliventer fabric	(sc. Melamme formaldeltyde reana
,s Synthetic rubber	(v Uren-formaldehyde resins
(/ abrenkable mork	ery " cis-polyteoprene

27 Match the polymers given in Column I with their repeating units given in Column II.

Column I	Column II	
a Aeritan	a ← -CH ₂ —CH———	
	C_0H_3	

	C.
<i>Б</i> Рајустучење	$a \mapsto CH_2 C \mapsto \overline{C}H CH_2 +_{h}$
c- Neopreue	$\alpha \leftarrow CH + CH + CH_1 + CH_2 + CH_3 + CH_4 + CH$
(a) Novolan	{r →CH CH→
	t'N
	NO NO
,e) Huns—N	(A) CH, CH,
	et +CH, -CH +
	CI

26. $a' + (m_1, sb) + (ob, (c) + (ab, (d) + .arb, s) + .in, sf) + .in) 27 (a) + .ob, b' + (ab, (c) + (in, d) + .ob, (e) + .iii)$

-- Resertion and Reason Type Questions



- Nute: In the following questions a statement of assertion followed by a statement of reason is guest. Choose the correct answer out of the following clusters
 - Assertion and reason both are correct statement but reason does not explain assertion.
 - (b) Assertion and reason both are correct statements and reason explains the assertion.
 - (c) Both assertion and ressuo are wrong statement
 - Assertion is correct statement and reason is wrong streamen.
 - (e) Assertion is wrong statement and reason is correct statement.
- 28. Assertion : Rayon is a semi synthetic polymer and is taken as a better choice than cotton (abric
 - Reason Machanical and seathetic properties of cellulose can be emproved by acetylation
- 29. Assertion: Most of the Synthetic polymers are not biodegradable

- Resson. Polymerication process tudines to se character in organic molecules.
- 30. Assertion : Obsfinic monomers undergo addition polymerantion.
 - Reason t Polymerisation of vinyl chloride is imbated by peroxides/persulphates
- 8t. Assertion. Polyamidez are best used as fibres because of high tensile strength.
 - Reason Strong intermolecular forces like hydrogen bonding within polyamidas) lead to close packing of chains and increase the crystalline character, hence, provide high tensile strength to polymers
- Assertion : For making rubber synthetically isoprene molecules are polymerised
 - Reason Neopreus a polymer of chioropreus is a synthetic
- Assertion Network polymers are thermosetting.
 Resson Network polymers have high molecular mass.
- 84. Assertion. Polytetrafluoroethens is used in making nonstick cookwares

Reason Fluorine has highest electronegativity

Hints & Explanations for Difficult Objective Type Questions

A. mcq with only one correct answer

A16 a Caprelecture us a minimum of cylon-6

A24 c Henroquinone solubita the free radical polymerisation of vinylic derivatives.

A28 c Terviene us

B. mcq from Competitive Examinations

B2 d) Nylon 8,6 is prepared by condensation polymersection.

B4 a Neoprene is a polymer of chiorogrene

$$cH_{1} = cH \quad c = CH_{1} \quad \underline{\text{Primeriumve.}},$$

$$cH_{1} = cH = C - CH_{1} \quad \frac{1}{2}$$

Bo b Nylmo-0, 0 is an example of files

B6 α Nylon is an example of polyamide

B7 a CH₂-O-CH-CH₃ Chloroprene is monomer of

пеортере

B12 c Natural cubber has all cis-configuration of double bunds.

B14 d) Cross anked or network polymers are usually formed from in-functional or tri-functional monomers b and contain strong covalent bonds between various anear polymer chains (a. like melanine, bakelite, etc. c

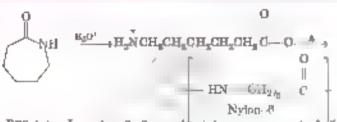
B18 d) The monomer of natural rubber is isoprese and not buyednese

B24 ,d) Nylon 6,6 has strong intermolecular forces. It has amide anthogon and therefore, has strong hydrogen bunding between two polyennils chains.

B27 5 Decron is a condensation polymer formed by the condensation of OH group of ethylene glycol and COOH group of terephthalic and with the elimination of water molecules

P29 z') Buokets and doublins are manufactured from high density polythese

B30 v Formation of nylon-8 involves hydrolysis of ite monomer (esprelactam in initial stage



B32 (a) In aylon 6. 6; amidé linkage is present. Artide linkage is pular, hence is strongest. Out if Buna-S and polythena, Buna-S has greater surfain area. Hence it has stronger intermolecular forces.

B88 (a. Terylene is a copulymen formed by the condensation of tersphilipane acid and ethylene glycol.

B41 (c) Novoing a mittal product obtained in the condensation of phenol and formide by de.

B42 (c) * Terylens is a condensation polymer and is not a chain growth polymer

B47 to . Bullet proof helmets are made from lexan

B48 b, Natura rubberhas cus-configuration at every double bond.

B52 b) Protours are condensation polymers of (t-amino acids

B38 (d) Dacron is prepared by condensing terephthalic and and ethylene glycol

B54 (a) $CH_2 = C$ $CH = CH_2$ 2-Methyl but 1, 5-diene CH_2

B55 (c) Dacron is a condensation polymer

Bö6 (b) Nyloo-6,6 is a polyanide

B57 (c) PVC and high density polythene are anear polymers low density polythene is branched chain polymer while bakente is cross linked polymer

NCERT Exemplar Problems . MCQs Type-I

1. d) Glycogen is stored by animals

2. a. Cis-polyteoprene is a natural rubber

6. (c) It is not a good conductor of electricity

7. a The repeating structural units OH_a C(CH_a)_q and hence the monomer is reobutylene —<</p>

 d) The monomer is caprolactam and hence the polymer is nylon-6.

NCERT Exemplar Problems MCQs Type-II

 b. c) Bune-S 1.8-butadiene peoprene (2- chiorobuta-1, 3-dhene)

11. (a, d) Teflon and polystyrens are thermoplastics

18. c. d) Nylon and taryleon are used as fibres.

z, d) Vulcamention of rubber makes it more electioned and staff.



CHEMISTRY IN EVERYDAY LIFE



D. D. Banks Will

٠	Understanding Text	
٠	Conreptual Questions	€1.
	A PARTICIPATION OF THE PARTY AND ADDRESS OF	COLUMN TARREST

CHAPTER SUMMARY & CHAPTER ROUND UP 27

NCERT FILE

- In-text 45 & Exemples with Solutions
- NCERT Exemplar Problems with Answers & Solutions (Subjective 99

26

- Quark Memory Test with Auswers
- HOTS & Advanced Level Questions with Answer REVISION EXERCISES

fw...b Previous Years CBSEQa & Other State Boards vgs

 Hinta & Auswers for Revision Exercise

UNIT PRACTICE TEST

11		1	Militaria
-	DOMEST	IDOO I	ALCIN LINE
_ 1	. 11 1111 1	Alone I	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

- · ampatitive Examination Qe
- AIPMT & Other State Boards
 Medical Entrance

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- JEE Main & ther State
 Boards Engineering Entraine
- Nº ERT Exemples Problems Agentive Questions
- Hrote & Espirantions for Difficult Questions

C seroutive process of the source of the sou

85

16

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4D

chemical compounds, processes and principles. We always owe a dehi to chemists for their important contributions for giving as life saving drugs, synthetic libres, synthetic detergents, variety of rosmetics, preservatives for our food, fertuizers, pesticides paper, glass, strong materials, plastics, beautiful paints, etc. There is no aspect of our life that is not affected by the developments

in chemistry in fact chemistry is the single branch of science which profoundly influences the existence of human beings and the habitat. Thus, the manking owes much to chemistry because it has improved the guality of life.

SOME BASIC TERMS USED IN MEDICINAL CHEMISTRY

Medicinal cheanstry deals with the study of drugs. It involves their golebon and synthesis, characterisation and establishing links between their chemical structure and biological activity to be used in medicine for the treatment and cure of diseases.

Drugs

Drug is defined as a substance t chemical compound, used for the purpose of diagnosis, prevention, relief or cure of a disease.

The word drug is derived from the French word "drogue" meaning herb. Drugs are chemicals of low molecular mass about 100 to 500 u. These interact with macromolecular targets in the body and produce a biological response-

$$NH_2$$
 NH_2
 NH_R

Structure of sulphonomides

When the drug has useful action as in the diagnosis, prevention, treatment and cure of a disease, called therapeutic effect, it is called medicine. The use of chemicals for the speutic effect is called chemotherapy. On the other hand, If the drug causes a Larinful effect on the body such as a le effects in toxicity the drugs behave as poisons. These side effects or toxicity may also becar if the closes taken are higher than recommended. Drugs may be administered by oro i intravenous rigeotions, intramiliarmar mute at bousageous mute injects in beneath the skin substation or by local application. The route of administration of a drug is determined by its physics; and chemics, properties, the site of desired. action and the time course of the response desired.

Classification of Drugs

Drugs can be classified into the following simple ways:

(i) On the basis of pharmacological effect

This type of classification is braced on the pharmscological effect of the druge. For example, analgesics have pure relieving effect, autipyretics help in lowering the body temperature in filter or as samplica K. For access the growth of durtoorgan sans, and depresses so of the classifier above, etc. This classifier, it. is very useful for doctors because if provides them the whole range of drugs available for the treatment of a particular type of disease.

(ii) On the basis of action on a particular biochemical process

This type of classification is based on the action of a drug on a particular. brochemical process. For example, all antihistamine drugs inhibit the action of historiane compound which causes inflammation in body and atterpic reactions. The Grags will all are used to slock are notice, of instantances are given early open enas antihistenumes. Similarly, drugs related to gastro, otestinal mobility and secretion process (gastro intestinal tract) are grouped together.

(iii) On the basis of chemical structure

The only may also be consulted on the basis of their chemical structure The drugs asving similar chemical structures may have similar pharmscological. activity. For example, alcohols are known to possess bypnotic, analgenc and ar: touc action. So phonemiaes have common structura, formula as known.

Most of these show antibacteria, properties

(iv) On the basis of molecular targets

This classification is based on the molecular targets and is considered as he most useful mode of classification for medicinal chemists. Drugs usually attract with the biomolecules such as carbohydrates, proteins, gods and nucleic acids known as target molecules or drug targets. Liruga possessing same common structural features may have the same mechanism of action on aperator de granget inciencies. Many enzymes and receptors in the cells have some common drug targets.

Interaction of Drugs with Targets

Lrugs interact with macromolecules such as carbohydrates proteins. brade and a other ands. These macromalecules are known to perform inflerent. flunctions in the body. For example, different proteins perform several roles in the body

- The proteins which perform the role of biological can lysts are called enzymes.
- The proteins which are very vital for communication system to the body are called receptors.
- The proteins which carry the polar molecules across the cell membrane. are called earrier proteins.

Similarly nucleic neids are responsible for genetic information in the cells while carbohydrates and fats are the structural part of the cell membranes.

(1) Enzymes as drug targets

(a) Cotalytic action of Enzymes

We have already learning Unit 5. the role of enzymes in catalysing a reaction. In their catalytic activity, the enzymes act similar to lock and key principle. The enzymes perform the two main functions.

The first function of an enzyme is to hold the substrate for a chemical reaction. The substrate is held in active site of enzymes in such a position so that it can be readily and effectively attacked by the reagent. The substrates are bound to the among acid groups of the proteins called among and readiles on the active sites of the enzyme through different chemical forces such as some ionably hydrogen bounding, van der Waals forces not dipole interactions and dipole-dipole interactions. Fig. 1. The nature of the binding gives an indication of the duration of action. For example, whenever, a drug is bound by covalent bonding a prolonged furation is expected. However, these binding interactions should be strong enough to hold the substrate long enough at that the enzyme can eatalyse the reaction but weak enough so as to slow the products to depart.

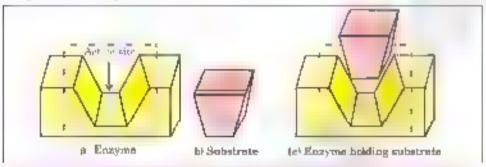


Fig.1. (a) Active site of an enzyme (b) substrate and (c) substrate held in active site of the enzyme.

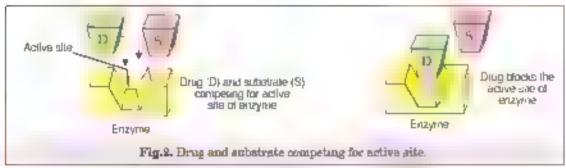
The second function of ensume is to provide functional groups inclined will attack the substrate and curry out the chemical reaction. This function is performed by some other aims in any residues of protein present in the artise sites of the enzyme. These provide free functions, groups, such as ...H. COOH, SH etc. is attack the substrate. For example, if arisino and residue is present nearby the substrate held in active site, then his ...CH group is free to act as nucleophile in the enzyme catalysed reaction.

(b) Drug-Enzyme Interaction

The main role of drugs in a either increase or decrease the role of enzyme catalysed reactions. Inhibitation of enzymes is a common role of drug action. Many drugs show their effects by modifying the function of enzymes. The enzyme inhibitors can block the binding site and prevent the binding of the substrate or can in, that the cate year are. It, of the enzyme Some of the enzyme innovates are useful therapeutic agents. For example, inhibitors of enzyme monoamine on asset MAO inhibitors are used as another essent agents. The drugs can inhibitor the attachment of substrate on active site of the enzymes in following two ways.

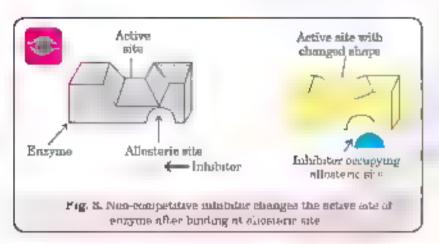
(i) Competitive inhibition

The substrate and inhibitor cannot bind to the enzyme at the same time. This isually results from the inhibitor neving an efficity for the active site of the enzyme where the substrate also binds. Therefore, the substrate and the inhibitor compete for the approach to the enzyme's active site. Such drugs are called competitive inhibitors (Fig. 2) shown ahead.



(11) Non-competitive inhibition

In this type, drugs donot bind to the set we save out bind to a different size if enzyme maked allosteric site. Fig. 3. Than and, ig of with otor at a losteric site changes the shape and conformation of active site so that the affinity of the substrate for the active site is reduced.



It may be noted that if the bond formed between enzyme and inhibitor is strong covident bond and therefore cannot be broken easily then the enzyme gets blocked permanently. The body then degrades the enzyme inhibitor complex and synthesises new enzyme.

2. Receptors as Drug Targets

Receptors or proteins majority of which are embedded in cell membranes. These are embedded in the cell membranes in such a way that their small part possessing active site projects from one surface of one membrane and opera upon the outside region of the cell membrane. This is shown in Fig. 4.

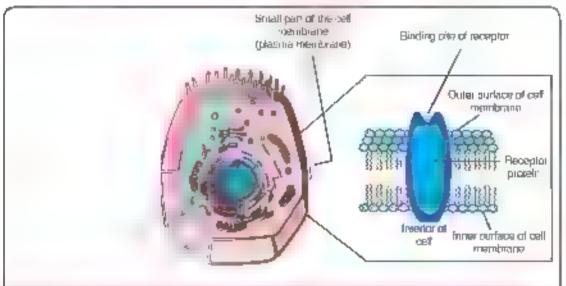
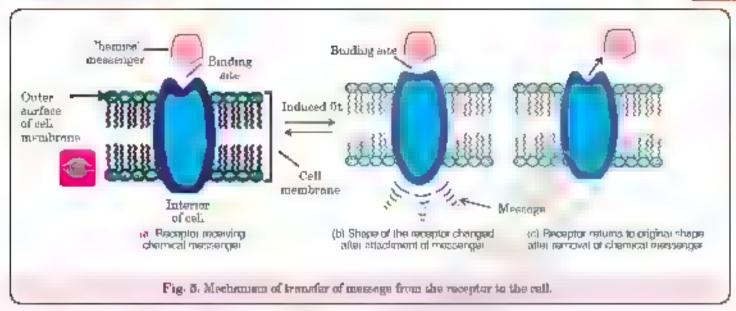


Fig. 4. Receptor protein embedded in the ref. membrane with the active site which opens on the untilda region of the ref. membrane.

As we know an the central nervous avatem, the information is conveyed and received by neurons. The information is transmitted from one neuron to another by nerve pulse. The шеванде регмени two neurons and that berween neurons to the muscles is communicated with the help of chenneals known as chemical messengers. These are received at the tinding site of the receptor proteins thig. 5 of To accommodate

the message, the snape of the receptor changes. After the transfer Fig. 5 (b) of the message, the chemical messager departs and the active site of the receptor protein returns to its original shape (Fig. 5 c)). The complete process of transfer of message from the receptors to the cen. a snown in Fig. 5, and results in the transfer of the message to the cell. Thus, chemical messagers give messages to the cell without entering into the cell.



There are two types of chemical messengers which are involved in the message transfer. These are

- , Hormones
- a) Neurotranamitters
- of Hormones

These are the chemical substances which are produced in ductiess glands known as endorrine glands. They exist the blood stream and are carried to different parts of the body by the blood stream where they activate all the recenture which recognise them for message transfer. They are not leact, vated very quickly. For example, adrenatine, epinephrine, as a hormone which is reseased from adrenatineal in a situations of stress or danger. It prepares the body humans or samuals, for physical exercise to bear the stress.

07 Neurotransmitters

These are small morecules which help in the transfer of nerve messages. Some common examples of neurotransmitters are acetylcholine serotonial dopomine, etc. A neurotransmitter is released by nerve endings and get bound to the active site binding are of the closely placed target receptor for a very short time to transfer message to it. It then departs quickly unchanged after transferring the message. The receptor them forwards the message inside the cell. After leaving the active site, the neurotransmitters undergo degradation and lose their capabilities of transferring messages are they are deachivated. The degraded products go back to the nerve endings to become active messages again. In this way, the cycle of message transfer is repeated again.

The mechanism of activating a receptor is same regardless of whether the messenger is a hormone or a neurotransmitter

Based on the activity of drugs, these may be classified into two main types

(i) Agonista

A drug which stimulates or activates the receptor to inchate a physiological response is called **agonist**. For example, acetylcholine is an agonist for the cholinergic receptor. These mimic the natural messenger by switching on the receptor. These are useful when there is lack of natural chemical messenger.

(ti) Antagonists

The drugs which occupy the receptor sites without producing any response are caned antagonists. These bind to the receptor site and inhibit as natural function. These stop the agonists from stimulating the receptors.

There are a large number of receptors in the body which interact with different chemical messengers. These receptors have binding sines with different shapes, structure and amino soid composition and therefore

Michigan Continues



■ Do drugs have side effects!

One of the major problem of phormocology is that no drug produces only a single effect. In addition to normal desired therapentic effect, drugs may cause other effects which may either be beneficial or harmfu. The side effects arise because a drug may bind to more than one type of receptor. For example. on anti-depressant drug is to interact with serotoom receptor However, side effect may occur if the drug interacts with Instanine or ncetylcholine receptors. The side effect may also once if the degraded product of the drug is biologically active and interacts with some other receptors.

show selectivity for one chemical messenger over the other. The receptor which inverset with a specific chemical messenger may differ in its binding sites. For example, there are two types of advenergic receptors named as α -advenergic and β -advenergy—oth of which can bind epidephysic. However, these two types have slightly different moding sites and therefore, it is possible to length drugs which with bind better with α or β -advenergy receptor. These are not distributed evenly throughout the body. For example, the heart has there of β - than α -advenergic receptors will be assues have more of α - than β -advenergic receptors. Therefore, the drug designed to interact with β - form will act on heart rather than on tissues.

CHEMICALS IN MEDICINES AND HEALTH CARE.

The chemical substances used for treatment of diseases and for reducing suffering from pain are as sed medicines or drugs.

The term observable and is used for the scar reproduct stateble charactes are used for the treatment of discusses. These is entire, a bove specific effects for destroying the moved of organisms without injuring the cells of the body. Little ancient practices of treatment of discusse like Ayurvedic, the Union systems or the modern aliopathic system. He mays used one characteristic origin. Let us use so some specific classes of drugs used in allopathic system. Some if the medicinal compounds are discussed below.

1. Antipyreties

The chemical substances which are used to lower the temperature of the body in high fever are called antipyretics.

Examples Aspirin acetal sasteyate acide, paracelamol and phenocetan.

Aspirin is prepared by acetylation of salicy ic soid using a mixture of acetic amoydride and glacial acetic acid.

2. Analgesics

The chemical substances which are used to relieve pains without causing impairment of consciousness, mental confusion, incoordination or paralysis or some other disturbances of nervous quiem are called analysis.

These are of two types

- (A Non-narcotte (non-addictive) drugs
- (ti) Naveotic drugs
- Non-narcotic drugs. The common non-addictive analgesies: re-uspirial and paracelamol.

Aspirus (2-acetoxy benzot: acrib is most farmmar example: It marists the synthesis of compounds known as prostagiandina which stimulate inflammation.



- Aspirin is an important non-narcotto drug. But overdoses of aspirin should be availed.
- Despite the popularity of aspirin, it is supposed to be toric to the liver. It gets bydrolysed in stomach giving sancyle seid which sometimes causes breeding in stomach. Therefore, overdosage and its use in empty atomach should be avoided. Calcium and sodiam salts of aspiring are more soluble and less hamiful.

In the two less and cause pain. These drugs are effective in reheving sketetal paint such as that due to arthritis. Aspirin has also been very popular because it has antipyretic (temperature lowering) properties. In we aspiring associate in the prevention of heart attack because it has anti-blood crotting action. In addition many other potential, as pheations of aspiring presently under investigation, include pregnancy related complications, virial inflammation in AIDS patients, Alzheimer's disease, dementia, cancer, etc.

Because of shortcomings of aspirin, other analgesics like naproxen, ibuprofen and diviolence sodium or polassium find use as alternatives.

2 Narrotic drugs. Certain narchics (which produce alsep and monaciousness are also used as analgesies. For example, morph in and its derivatives coderne, heroin manificand are used in severe pain as analgesies. These are known to be halot forming. When used in medicinal doses, these relieve pain and produce sleep. However, in excessive, poisonous, loses these produce support come, convulsions and altimately leading to death. These narrotics are also referred to as opiates because they are obtained form the appear in poppy.

These time genies are mainly used for the relief in postuperative pains, cardiac pain, and pains related to child birth and terminal cancer

It may be noted that ever now aspect a the drug of choice for the prevention of heart attacks and as a reliever of pain in angina.

8. Tranquilizers

The chemical substances used for the treatment of stress, fatigue, mild and severe mental diseases are called tranquitizers.

Tranque czers are neurologically active drugs which affect the message transfer mechanism from nerve to receptor. These are used to relieve or reduce mental tension, irritate ity excitement and anxiety leading to calminess. These form an essential component of sleeping pills. They art on higher centres of nervous system. These are also called psychotherapeutic drugs. These drugs make the patient passive and help to control their emotional distress or depression. These also help to restore confidence and the patient's work with full capacities which they already have

It may be noted that the narcotic drugs are known to be habit forming i.e. addictive drugs. Therefore, to guard against addiction and mist settless are not sold without prescription.

Tranquibzers and analgesies are neurological active drugs. These affect the message transfer mechanism from the nerve to receptor



The word tranquilizer is derived from the word tranquillus meaning raid.

Tranquilizers are essential components of sleeping piles.

Examples. There are various types of tranquilizers which function by different mechanisms. The most common one is noradrenaline which induces a feeling of well being and helps to changing snood. It is one of the neurotransmitter that plays an important rule in mood charges. If the level of noradrenaline is now due to certain reasons, then the signal sending activity of the normone secones tow and the person suffers from depression. In such cases, the potient needs antidepressant drugs which minibit the enzymes which catalyse the degree of it of noradrenaline. If the enzyme is interact, the metabolism of important neurotransmitter is slowed down and this can activate its receptor for longer periods of time and therefore counteract the effect of depression. The commonly used antidepressant drugs are intrinazed and phenelisms.

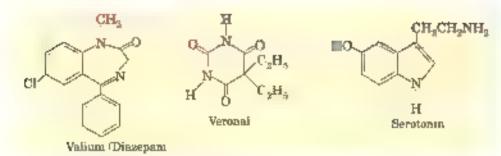
Some other most commonly used tranquilizers are harbituric and and its derivatives such as veronas, amytal, membutal, seconal and luminal.

These derivatives are called barbiturates. These are hypnoticise siem producing agents. In a binuon to barbiturates, a large number of other non-hypnotic tranquitizers are known. For example, chiorodiuzepoude and meprobamate are relatively mild tranquilizers suitable for relieving tension.

Equand is also an important transportant transport used in depress on and hypertension

Some other substances used as tranquilizers are valuated approximately or conn. serotones, etc.

^{*} Note: All complicated attractures are one evaluative.



4. Antiseptics and Disinfectants

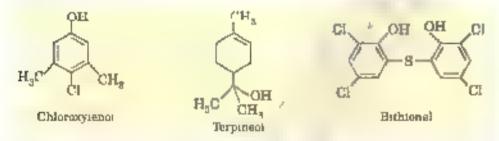
Antiseptios

The chemical substances which are used to either hill or prevent the growth of micro-organisms are called antiseptics.

These are not harmful to ring trusies and can be safely apputed on wounding cuts, racers, diseased skin surfaces. These are also used to reduce odours resulting from bacterial decomposition of the body or in the mouth. They are, therefore, mixed with decodorants, face powders and breach purifiers. We all must be familiar with antiseptic creams like furacin, sofrum win, etc.

The common examples of anhaeptics are

- d Deltal is an antiseptic It is a mixture of cli proxylenor and terromeo in a signature solvent. Chiproxyleno, has both apprepriate and last fectors proxyrhes.
- (ii Bithional is antiseptic which is generally added to medic feel scops to reduce the odour produced by bacteria, secomposition of leganic matter of the ekst.



(**** **lodine** a powerful an aseptic. It is used as a **tinoture of iodine** which a 2–9% of me solution of alcohor-water.

(rc) A driute squeous solution of boric nord is used as a weak antiseptic for eyes. It also forms a part of antiseptic haby talcum powders.

(c) Fodoform is also used as an antiseptic powder for wounds.

(rn Hydrogen peroxide is also used as a mild antiseptic under the name perhydrol for washing wounds, teeth, ears, etc.

(rit) Salot phenyl saucytate is used as an intestinal antisepho for throat suments.

(criti) Polassiam permangnate (KMoO₂) is used as untiseptic at dilute solutions.

(ix) Amyl metacresol. 5-methyl-2-penty' phenol. is an antisephic which is used commonly as mouthwash or gargles in infections of the mouth and throat

(a) Some organic dyes are also effective antinoptics. These are used for the treatment of infectious diseases. The rommon examples of antiseptic dyes are gention violet and methylene blue.

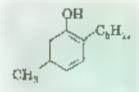
Distrifectants

The chemical substances which are used to hill ancro-organisms but they cannot be applied on living tissues are called disinfectants.

HOTE

It may be noted that different terms are used for drugs which are used to ours mental diseases. Some of these terms are

- (a Sedatives. These act as depressant and suppress the activities of central acryons system. They are given to patients who are mentally system and violent. Sedatives given feeling of campass, remarkion or drawsiness in the body. Their high doses induce steep. The common sedatives are valuing, barbiturates obtained from barbiturns and).
- (ii) Antidepressionts. These drugs are given to patients with shottered confidence. These produce a feeing of well being and confidence in the person of depressed mood. Therefore, these are also called mood booster drugs. The common examples are minimized in the common examples are minimized.
- (111) Hypnotics. These are also known as tranquinzers and are used to reduce mental tension and anxiety. The lower doses of hypnotics or tranquinzers generally do not induce sleep.
- (iv) Narcotics. These act as depressent and analgeoic. They reduce tension and anxiety and also reduce pain. The common examples are option, because pethiding.



Amyl motacresor

Thymal

Ehrlich Paul got Nobel Prize in medicines in 1908 for his discovery of araphenomials known as Salvarsan for treatment of syphias.

Therefore a safectants a so kill ancro-organ is as a till ese are not safe for at ag basiles. Therefore, a pulsus to tadjor role is water area near the public health sam ation. These are commonly applied to manimate objects such as flows, dramage system, instruments, etc.

The same a between an act as can dectant as well as massept. Repending upon its concentration. For example, a 0.3% solution of phenol acts as antiseptic and its 1% solution acts as disinfectant.

Some other common examples of disinfectants are

(f) Cl_1 is used for making water fit for any king at a concentration 0.2 to 6.4 ppm.

the Low concentrations of sulphur droxide are used for stem drug and preservation of squashes.

tire A nature ty occurring phenon femont we thy moles used as powerful disinfectant than phenol

(iv) A solution of cresols (i.e., o-, m-, or p-methylphenols in sospy water is called lysol and is used as a disinfectant for floors

5. Antimalarius

The chemical substances used for the treatment of malaria are called antimalarials.

The alke oid quintue has been sed as an antima erial for a long time. These days a number of aventhetic drugs have been prepared for the treatment of malana. For example chiloroguine, paraquine, primaquine, etc.

0. Antimicrobinas

These are the chemical substances used to cure infections due to micro-organisms.

The disease in I must beenge and air make may be caused by a variety of n orniorganisms such is sactema virtuses, flarge etc. The intero-organisms are extremely small organisms which can be seen only with a microscope These are also soled microbes. Any organism which raises disease is raised pathogen. Howe er body possesses an efficient natural defence mechanism which ignored exect of Lames ago just potential polihogenic interobes. The skill is agreement to remains Our nors body secretions eather kill the microlles or able a regrewth The common examples of secretaria are vso your and idar in agree the interest leads, secretary salve fatty and and lacter acid in sweak and sewaceous secretions and hydrochland acid in stometh. The pathogens reach the wastles due to a breach in defence merhan am and cause infertion. as non-oud must also at our organism to a feeted that flextroys the norma, cell metabol em and cause physiologica, disturbances to the body which a_k -praise in the form of some disorders or diseases, in addition. Axic substances sound produced by the microbes may adversely affect the tissues or organs of the nost

The convrol of microbial diseases can be schieved by the following three ways

- 1. by drugs which kill the organism in the body (bactericidal),
- 2 by brugs which is in or arrest the grows, of one organism (bacteriostatic) and
- by increasing immunity and resistance to infection of the body (sumunity).

In the early 20th century, the accents is tried to search the chemicals that would adversely affect the areating natural by not the time. Find Elizabel, a German bacteriologist investigated aream based structures in order to produce less had substance for the treatment of sypholes. He developed a medicine arephenamine (known as Salvarsan, as the first effective treatment for aypholes Ehrholi Pau, got Nobel Prize it medicines in 1908 for the 1 structure. Atthough salvarsan is come to human beings but its effect on the bacteria Speriothete which causes syphilia is much more than on the human beings and hence 1 con, it he need for the treatment. By studying sum; arrives it structures

of salvarsan and azotives in which the linkages. As=As- are similar to N=N- ankages in azotives, he therived that theses are coloured by the dyes selectively. In 1932, he succeeded to preparing the first antibotterial agent known as prontosid which resembles in structure to salvarsan.

This fed scientists to study the relationship between structure and activity of medicinal compounds. The part of prontosit shown in the box is p-amino benzene sulphonomide sulphandamide which showed an abacterial activity

Antimicrobia, substances may be synthetic chemicals like **sulphonamides**, **paraumino salicylio acid** or they may be antibiotics like tetracycline, pencillin, chioramphenicol, etc. (discussed later).

The common example of antinucrobial drug is sulphantiamides which are effective in wide range of micro-organisms. These are structural analogues of p-amino benzing and.

Large number of derivatives of so-phanuamide such as sulphadiazine, sulphadimidine, sulphadime hoxine, sulphadoxine, sulphadoxine, sulphadoxine are being used as antimicrobials. One of the most effective is sulphapyridine.

Sulphonamides in combination with trimethoprim are preferred in the treatment of infections of urinary tract

7 Antifertility drugs

These are the chemical substances used to control the pregnancy. These are also called **oral contraceptives**. The besic aim of antifertuity drugs is to prevent concept, in or fertuization and therefore, these are also known is **buth control pills**.

Or a contraceptives belong to the class of not and products known as steroids. These are the active ingredients of the pill functioning as an antifertility agent. These control the female mensional cycle and ovulation. It is estimated that about 50-60 halls in women throughout the world take these pills as the printary form

of contraception. The birth control pills are essentially a mixture of estrogen and progesterone derivatives. Both of these compounds are normones, it is known that progesterone suppresses avulation. Synthetic progesterone derivatives are more potent that progesterone. For example, norethindrone is an example of synthetic progesterone derivative which is most widely used as antifertally drug. The estrogen derivative which is used in combination with progesterone perivative is ethypylestradiol (novestrof).

Mifepristone is a synthetic steroid which blocks the effects of progesterone and is used as a "morning after pill" in many countries.

Ormeloxifene Cantchroman Saheli) has also been developed and tested at the Central Drug Research in subtate. Lucknow as an effective anti-fertility drug to acceptable degree. The oral contraceptives are commonly known as pills or oral pills and have been used worldwide for birth control methods. The importance of antifertility durgs to be succeeded by the fact that several Nobel Prizes have been awarded for research to steroid chemistry.

8. Antibiotics

These are the chemical substances which are produced by microorganisms (bacleria, fungr and moulds) and can inhibit the growth or even destroy other micro-organisms.

However the development of synthetic methods has resulted in a modulication of this definition. Now antibiotic refers to a substance produced wholly or partly by chemical synthesis, which in now concerns con numbers the growth or destroys nucro-organisms by intervening in their metabolic processes. In other words, and their intervening in their metabolic processes. In other words, and their intervening in their metabolic processes. In other words, and their intervening in their against another. This is because antibiotics themselves are products of interobial growth.

The first successful antibiotic produced was pencium. It was discovered by Alexander Fleming in 1929. The general formula of pencium is C₁H₁ · SN₂R where R may be different for different members. With the substitution of different R groups, a roll six natural pencium have been isolated at far. For example,

Penicillin	Nature of R
Pemeulin G or Benzyl pemculin	
Pencilin F	GH_{η} AH_{η} $AH = AH + OH_{\eta}$
Peniciin K	CH ₄ + TH _k
Pentellin V	C'H'UCH'
Ampiculin	⟨ С.н
	NH ₂

The enablotics may be eather bactericidas kides the organism in the body or bacteriostatic (inhibits the growth of organisms). These are

Bacteriesdal	Bacteriostatic
Penicilim	Erythromyein
Anmoglycosides (Streptomycin)	Tetracycline
Officiario	Chioramphenico.

The complete range of intercorgaments attacked by an antibilitie is called its spectrum

Periodito has a narrow spectrum. These can be used for curing sore throat, gonorrhoes, rhemmatic fever, iocal, infections, etc.

Ampiculin and amonycilin are some modifications of seach line. It may be noted that many patients develop allergy to periodilin. Therefore, it is essent all to test the patient for sensitivity, allergy, to penics his before it is administered.

X = H for ampicitin, X = OH for amonymitin

In India, the important centrus which manufacture Pomellin are Hindustan Antibiotics, Pumpri and Indian Drugs and Pharmaceu icals. Rishikesh and in private sector industry

Streptomyern and neomyern antibiotics are specific for certain diseases such as tuberculous, meningitis, pneumonia, local infectious, etc.

Broad spectrum antibiotics. These or the arbital schick are effective against several types of harmful a cro-organ sms. Therefore, these are used for curing a carrety of diseases. The cummon examples are letrocycline characteristic and characteristic which are effective against a variety of diseases. Chloramphenicol is a broad spectrum antibiotic which was isolated in 1947. It is rapidly a sorbed from the gustromitestimal tract and hence can be given orally. These can be used for ruring typhoid active fever, dysenlery, whooping cough, pheumonic level of ethoramphenicol is

Chloramphemicol

Other important broad spectrum antibiotics used are concompcia and offoxacia. The antibiotic dyadazirine is found to be toxic towards certain strains of cancer cells.

Sulpha drugs. These have great antibacterial powers and are used as medicines for various diseases. These are also antibiotics and protect the oody against micro-organisms. These are used against hiseases such as

NOTE

The range of bacteria or other microorganisms but are affected by a certain autoholic is expressed as its spectrum of action.

- Anabistics which his or allabets wide range of gram-positive and gram negative bacteria are called broad spectrum on theories
- The antituotics which are effective orano, against group-markive or grain-negative bacteria are called narrow specturin antibiotics.
- The authorize which are effective ngalast a single organism or disease are called limited apectrum antibiolics.

H W Florey and Alexander Fleming shared their Nobel Prize for medicine in 1945 for their independent contributions to the development of penicular presimenta, tubercutesis, diplicheria, etc. Some important sulpha drugs are sulphadiazine, sulphathiazole, sulphanilamide, sulphaguanidine, sulphaavelamide, etc.

$$H_2N$$
 \longrightarrow SO_2NH_2 \longrightarrow SO_2NH \longrightarrow $Sulphediazine$

9. Antaculs

Acidic stomach is necessary for good health, but excessive scidity in the atomnolic on on se discomforts such as neid indepention, heart burn, irrusting mean of gastric alcers.

The chemical substances which neutrolise excess acid in the gastric junces and give relief from acid indigestion, acidity, heart burns and gastric vicers are called autocids.

This, antacids remove the exists indicate the pH to appropriate level in stomach. And gastratis is one of the common at ment associated with digestion. It is caused by excess of a literalism and in the gastra juice.

Baking soda sodium bydroges derbounts in water is very common an are I. The bases most wicely used in antacida are

- Magnessum hydromde, Mg CH_m, magnessum carbonate. MgCO_g and magnessum trisilicate. These also act as laxatives.
- Aluminam: y srowde ge apumari in phost intel ilitydroxy ali minaun;
 amino acetate.
- Magnesia, and MgO is also sed as an antorid ingredient since it reacts with water to form magnesium hydroxide MgtOH₆.

The antands are available in the form of liquids, gels or tablets. Generally log at an another the nore effective than tablets because they have great at risce area available for interaction and neutralisation of and

Und 197 or ments such as sodium blearbonate or a mixture of all minimum and magnes um hydroxide have been commonly used for the treatment of neithty

It may be noted that the excessive use of hydrogenearbonate can make the at much alkatine and trigger, he product in of ever, more and. Metal hydroxides are better attendatives because of being and their these donor necesse the product neutrality.

A major advancement in the treatment of hyperscribty came through the discovery that histamine stimulates the secretion of pepsin and hydrochloric and. To prevent the interaction of histamine with the receptors present in the stomach wall, the drug simetidine also called **tegamet**) has been designed. This resulted in release of lesser amount of and. This drug has been replaced by another drug runitidine zames, and is used to even heal peptic olders.

It may be noted that the treatments of acidsty with antacids control only the symptoms and not the cause. Therefore, with these metal salts, the patients cannot be breased easily. In advanced stages, ulcers become aft threatening and its only treatment is remove; of the affected part of the stomach.

Some sodium sultantacids may cause bypertension because of increase in sodium ions concentration. Therefore the excessive use of these antacide containing sod unions is not recommended for petientalisting high blood pressure.

_fistamine

A new class of drugs omeprazole and lansoprazole are most effective durgs which prevent the formation of and in the stomach.

It may be noted that milk is a weak antacid which also possesses a protective action.

10. Antihistummes

A number of different sensitising substances (called antigens, derived from food or environment may cause allergic reactions in human beings. This is due to the release of a chemical substance called histamine in the body.

Histamine is a potent vasodilator and performs various functions. For example, histamine contracts the smooth muscles in the bronch and gue to which patients of asthma are very sensitive) and relaxes other muscles such as those in the wails of fine blood vessels. Histomine is also responsible for the nasal congestion associated with common colds, cough, allergic response to pollens, etc.

Antibistamines are chemical substances which diminish or abolish the main actions of histomine released in the body and howe prevent the allergic reactions.

Symmetric using anchies bromphericamine (dimetopy and terfereadine seldane) are used as an abstainines. They interfere with the natural action of histamine by competing with histamine for binding sites of receptor where histamine exerts its effect.

Antihistamines are also called **antiallergic** dirags. These are used to treat allergy e.g. skin rashes. Other allergic reactions to conjuctive ideas inflammation of conjuctive if eye and rimmas inflammation of mass, to cosa. In seasonal thintie and conjunctivities, these Art ga relieve successing, mass) incharge, third astima, liching of eyes, more and throat

The common an distantine drope are diphenyl hydramine. Benadrylphenicamine maleste. Avan chlorphenicamine. Zeels, promotharine,
triprobleme actidals antazoline contistanes, dimethindene foresta.

11 Anaesthetics

These are the circumore substructs which produce general or local insensibility to pains and other sensations. Coraine and novocaline are local anaesthetics. Chloroform, diethyl and vinyl ethers, etc. are general anaesthetics.

	Chemicals in medicines				
۰	Analgesses	ī	Reneve pain	Aspero, ibaprofeo, dicioleane sodum, noproseo darcoles (morphine, ocdense, beroin	
	Antipyretion	1	Lower body temperature	Aspina peracetamul phenacetan	
۰	Antiseptics and thionfeotions		Kill or present the growth of micro-organisms	6 % phenol enterphic est phenol distributes duorate destro) eldonoxyleno and tempureo) historian todine come	
۰	Tranquilizers		Treatment of stress, mental therases	need Therevalives of borbs ours and version, ampta, memberal annual, seconds, chlordingsponds, meprobamats, valum,	
	Antimierobiala	E	Cure infectious due to micro-organisma numbes	Antibiotics, surphenous des	
۰	Antifertially drugs		Birth control	Oral contrareptives, estrogen, ethynytestradios an progesterine nuiethindrone milepristone	
•	Antibiotem	 	Produced by micro-organisms and can inhibit the growth of other micro- organisms	nd Penician te re yebbe charemphenicot ampienim	
	Antacida		To a second second	รณ์ทุกกรุณภาษีเกล	
•	Antacius		Remove еховая выш из ысиллей	Magnesium, surcode magnesium carbonate magnesium triements disminium hydroxide gel sodican bicarbonate access roun phospha a prazole innsoprazole.	





Q.1. (a) Why is bithronal added to soap?

Which class of drugs is used in sleeping pills?

⁴D S.B 2018, A.L.S.B. 2018.

Ans. a' Bithionn' acts as an antisentic agen, and reduces the odours produced by the barterial decomposition of organic matter on the skin.

6' Tranqui azers

Q.2. (i) What class of drug is Romitidize?

(U) Which of the following is an antiseptic?

0.2% phenol, 1% phenol /

(A.LS.B. 2018)

Ans. O Antend

a 0.2% phenol antiseptic 1% phenol disinfectant

Q.3. Pick out the odd one from among the following compounds on the basis of their medicina, properties mentioning the reasons

Luminal, second, phenacetin, equant.

Ans. Phenacetan

Q.4. Pick out the odd one out from among the following on the basis of their medicinal properties mentioning the reason:

Chloroxylead, phenol, chlorampheason, bithional.

Ass. Chloremphement

Q.5. Name a broad spectrum analysotic and two diseases for which it is prescribed.

Hr. S.B. 2018, H.P.S.B. 2013, James S.B. 2015.

Ans. Chioremphenical is a broad spectrum antibiotic.

It is prescribed for curing (i) typhoid (ii), dysentery

CONCEPTUAL

Q.8. Which chemical is responsible for the antiseptic properties of dettal?

CBSE Sample Paper 2012, Assam S.B. 2012,

Ans. Chloroxylenol.

Q.7. Name a substance which can be used as an antiseptic as well as disinfectant.

(HPS.D. 2017

Ane. Phenoi

Q.8. Name the class of antimicrobial drugs.

Ane. Sulphonamides

Q.9. Name the most common antacid.

Ane. Baking sode

Q.10. What are antibiotics? Name the first antibiotic discovered?

'Meghalaya S.B. 2018,

Ans. Artibiotics are chemical substances which are produced by uncon-organisms backers fungi and moulds and one inhibit the growth or even destroy other micro organisms.

Peniculm was the first antibiotic discovered

Q.11 What type of drug is phenscetin?

(Hr. S.B. 2018)

Ane. It is an appretic

Q.13. Give an example of a sulpha drug.

Ph.S.B. 2002, Assum S.B. 2018,

Ans. Sulphadiezone

Q.3. A pum reliever used for relief from severe pain like post-operative pain or pain due to terminal sancer-(CHSE Sample Paper 2011).

Ana Murphine

Q.14. Name one substance which can not as both :

Ans. (n/Aspirin (in) Phone)

Q.15. What are the main constituents of dettal ? ... /

(D.S.B. 2011)

Ans. The main constituents of detail are childregished and terposal in a smalle solvent.

Q.15. What is tincture of indine and what is it used for ?

Pb. S.B. 2013, Assem S.B. 2013, H.P S.B. 2018, A.I.S.B. 2011,2018.

Ans. 2-8% indine solution of alcohol-water is called tanture of indine. It is a powerful antiseptal and is applied on wounds

Q.17. Giving one example of each analysmos and tranquibzers.

(Uttarakhand S.B. 2018)

Ans. Aspirin, normitreonane

Q.18. Sleeping pills are recommended to patient suffering from sleepness but it is not advisable to take them without consulting the doctor. Why?

(Assum S.B. 2013)

Ans. Most of the druge taken in dose higher than recommended dose may rause harmful efforts and art as poison reading to death. Therefore, a doctor must always be consulted before taking any medicine, who will advice the patient for proper and safe doses of the drug.

Q.19. Name first antilnotin. /

(H.P.S.B. 2018)

Ans. Penicillin

Q.20. Name the medicine which reduces fever.

(Hr S.B. 2013)

Ans. Antipyreties e.g. paraestamal

Q.21. Give the name of one neurotransmitter.

(Megholoyo S.B. 2018)

Ann. Acetylcholme

CHEMICALS IN FOOD

Many chemicals are added to food for their preservation and enhancing their appea. These are called food additives and are

- Flavours and sweeteners.
- (it, Food colours dyes.
- (m) Fat emuisifiers and stabilising agents
- Flour improvers antistaling agents and bleaches

The preservative action of sodium or potential metasulphites. No.S. C., or N.S. O., is due to SO, which dissolves to water to from sulphirous and H.SO.,

Suphurous said inhibits the growth of years, moulds and bacteria. Instead of Na₁S₁O₂, SO₃ itself can be used as preservative for fresh vegetables and fruits.

- (v) Anboxidanta
- vi. Preservatives
- m_{ij} Nutritional supplements such as vitamins, minerals and amino acids.

Except for a unitional supplementa. All other donor have a tritive value. These are added to increase the self-life of the stored food or for cosmetic purposes. Antioxidants, preservatives, fat emplishers and standard agents as well as flour improvers are used to increase the self-life of the stared food while does. flavours and sweeting agents help to improve their cosmetic value. Some of these are discussed below.

1. Food preservatives

These are the chemical substances which are added to the food materials to prevent or retard their sportage and to retain their nutritive value for long periods.

These preservatives prevent the remaining of food and inhibit the growth or kill the intere-organisms. The common salt sugar rolls and spices provide a medium that resists the activity of micro-organisms in food. The preservation of food by adding sufficient amount of socilous corted satting. It is used for the preservation of row mange, and a beans, tamarind, his, mean etc. The saw prevents the water from being available for incrobial growth.

Sugar syrup is used for preserving many fruits such as apples, mango, strawberry, carrot, etc

Beendes augar and seats, other substances such as vinegar loss, spices, introsoid are also used as food preservatives, which are used for pickles, ketchups, jams, squashes, etc.

The growth of microbials in food materials can also be prevented by adding certain chemical substances

Sodium benzonte $(C_8H_8COON_8)$ is the most commonly used preservative. It can be used safety an immed amounts and as metabolized by conversion to happened and $C_8H_8CONHCH_8COOH$, which is altimately excreted an abetinine.

Salts of propiome acid and sorbic acid are used as preservatives for controlling the growth of vesste and moulds in food items such as cheese, pickles, baked food, certain mest and lish products.

Sodium or potassium metasulphutes source of sulphur dioxide are used as preservatives for jama, squashes, pickles, etc.

Certain food preservatives such as butylated hydroxyamisole (BHA) and butylated hydroxy toluene (BHT) for edible oils also act as antioxidants. Salts of sorbic acid and propanoic acid are also used as preservatives.

2. Antioxidanis

Fate and oils, and the foods containing fate and oils are readily condised, they turn rancid and their smell and taste change. As a result of rancidity they become appalatable. Usually substances which prevent oxidation of foods containing fate and oils are added and these substances are called automedants. Thus,

antioxidants are substances which prevent or retard the oxidative deterioration of food.

The anticondants act as secrifical materials because they are more reactive towards condution than the food materials. These anticondants also minimize the damage to some amino scids and the loss of some vitamins due to rendictly During condution or food, free radicals are generated. The anticondants react

with these free reducate and stop the chain reaction if oxidation of the food. Thus, anticadants decrease the rate of involvement of free radicals to the aging process. The most common antimidants are butylated hydroxy toluene. BHT) and butylated hydroxy unisole (BHA)

These phenolic compounds are added to preserve fata in packaged food bygen reacts preferentially with BHA or BHT rather than oxidizing fats or oils and therefore, these prevent oxidative spoilage of food items.

Sometimes BHA and BHT are added to food -tems in combination with critic acid or ascorbic acid to produce a more active synergietic effects.

Sulphur dioxide and sulphite are also used as antioxidants for their technological efficiency and versatility. They are active as antimicrotus, agents, structure, nodifiers, antioxidants and enzyme attributors. The sales user, are sedium or potassium sulphites and bisulphites. They are commonly used in wine and nears, fruit juices, pickles, sugar syrups and cut peeled in dried fruits and vegetables.

8. Artificial Sweetening Agents

These are the chemical compounds which give accelering effect to the food and enhance its odour and flavour,

Natural sweetening agents such as sucrose, northern hack stigar), cane syrup, honey are most widely used. However, the sum to our calone intake and therefore, many people prefer to use artificial sweeteners. Some important artificial sweeteners are:

Seccharin ortho-sulphobenzimide It is first most popular artificial sweetening agent. It has been used as a sweetening agent for many articles of food ever since its discovery in 1879. It is 1.2-benzisothiazolin-8-one-1.1 dioxide and noture as white mystathine powder. It has very sweet taste and is about 550 times more sweet than success. It is excrete, from the body in urine unchanged. It appears to be entirely mert and mirrores when taken. Its use is of great value to diabetic persons and people who need to control intake of calories.

Sodiam sait of saccharin is water soluble sait which is more palatable and free from unpleasant after taste of saccharin. It is the dihydrate of the sodium sait of saccharin. Its calcium sail is also water soluble and is used.

Aspartame. It is one of the most widely used artificial sweetener. It is taethyl ester of dipeptide throved from aspartic acid and thenyle same. It is about 100 times as sweet as sucrose. It may be noted that aspartame is unstable at rooking temperatures and therefore, it is used as sugar substitute to cold foods and soft draws.

- ni) Alitame. It is a high potency aweetener and is more stable than aspartume aring cooking. However there is one main difficulty with a itame and similar type of high potency sweeteners that it is difficult to control the sweetness of the food to which they are added
- A Sucratose. It is trichloroderivative of sucrose. Its appearance and laste are similar to augar and is stable at cooking semperature. It foes not provide calonies.

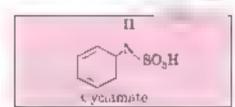
Ascerter and vitamin C and teceferots (vitamin E' have also been used as automore)

Somum soft of saecharm

Shochamme and its sales have been proved to be a diseaser for nutritiess distance and is of green value to people who used to control intake of caloness.

These artificial sweetening agents are constituted from compounds that unitar the effects of sugar on the tong to but no not cancergo the mortenical reactions in the body. In other words, they pass through the human body to metabolised receiving producing any courses. Asymptome is an exception because the body breaks in down into naturally occurring amino acids and menthal and absorbs these as usua. Therefore, these actificial supplements are called low onlone sweeteners or calorie-free sweeteners. A polyhydriny compound, xyhool, it deep daily sweeteners in sugarless grait.

Artificial sweetener	Structural formula	3	Sweetness value to comparison to cons sugar
Aspartane HO—C-	H H O H H O -C-C-C-N-C-C-O-CH, H NH ₂ H-C-H		£00)
Gram.	aspartic acid	rom phenylalania methyl ester	DE
	NHCONH ₂		
Dulcin		/	200
	OC3H4		
Sucralose	HO 3 H OH OH OH OH OH OH OH OH OH	н но сн ₂ ст	96-0
	c	H ₃ CH ₃	
Antame	H NH ₂ H H (-C—H B	200G
	C	II.3 CH3	



In recent years, there has been a great search for a safe, calorie free sweeteners to help diabetes who want to control sugar intake. Calorium cyclamate was used as calorie free sweetener. However, its use was banned in a noted States because of a suspected link with rancer. Sucratose is expected to become a great commercial sweetening agent.

CLEANSING AGENTS

Scaps and detergents are substances which are used for cleaning. Scaps are very popular cleansing agents which have been used for more than two thousand years. The scaps are sodium or potassium saits of higher fatty acids containing long chains of z6 to 18 carbon atoms. The common examples of higher fatty acids used for making scaps are

 $C_{15}H_{35}COOH$ $C_{15}H_{35}COOH$ $C_{15}H_{35}COOH$ $C_{15}H_{35}COOH$ Parameter and Steeric and Oleve and Limiter and

Sodam; or potasse im salts of these higher fatty acids are soaps. For example sodium palmitate, sodium stearate, sodium oleste, etc.

Soaps are made from aromo fats or vegetable oils. Fets and oils are estern of higher fatty ands and glycerol. The esters of glycerol and algher fatty ands are called **glyceroles**. For example, the tristearate of glyceroles called **tristearate** a tripolimitate of glyceroles called tripolimitin

When this find fats (glycerides are heated with a solution of with inhydroxide they break down to sod an sait of the respective fatty and onesoa, and glycerol. This process of making soap by the hydrogens of face and oils with alkalies is called saponification.

The scap is separated from the solution by the addition of common salt (NaCh, Sait is added to becrease the solution. Some in matter than water and it floats on the surface from where it is removed. The solution remaining behind contains giver of and sodium chloride. If years is recovered from the solution as it is very useful chemical used in drugs, cosmetica, explosives and paints.

Soap is mixed with desired colours perfumes and chemicals of medicinal importance m, g in neem coap, carbons $\cos s$, etc. It is then east into desired shape for use

Types of Soaps

All scape are made by forming face and offs with suitable somble hydroxide Variations are made by using different raw materials. In general, sodium scape are hard whereas potestion some are soft. Some important types of scaps are

- or Toilet sonps. These are prepared by using better grades of this and fots and care is taken to remove excess aikal. Therefore, these soaps are normally free from excess alkali and form more lather—olours or perfumes are added to make them more attractive.
- (ii) Medicated soaps. These soaps are the soft soaps commang substances of medicana, value. In some soaps decorrants are added. Neem soap, carbons soaps are some common examples of medicated soaps.
- (iii) Shaving scaps. These scaps are potassium sodium stearates and produce eating lather. These comman giveeror to prevent rapid drying. A guin called rosulue added in these scaps which forms sodium rosunate which tathers well.

Like D-sugare, L-sugare are also awest in tasse but donot provide energy because our body does not have enzymes for their metabolism. Therefore, these are secreted as such from our body through urine. So these L-sugars (L-glucose L-gausetose, etc) have been synthesised and can be used as artificial awestering agents.

- (7c) Laundry soaps. These soaps contain filters ske sod; un resmate sodium silicate borax and sodium carbonate.
- (v) Transparent soaps. These soaps are prepared by dissolving the soap in ethanol and then evaporating the excess solvent
- (c) Floating soaps. These soaps float in water and are prepared by beating tiny air bubbles into the product before it bardens.
- (WI) Soup chips. These are prepared by running a thin sheet of melted soop into a cool cylinder and ecrapping off the soops in small broken pieces.
 - (1711) Soap granules. These are dried ministure scap hubbles.
- (i.v.) Soap powder and securing soaps. These substances contain some soap, a scottring agent a trasive such as powders, purifice or finely divided and and builders like sodium carbonate is d tracely in phospitate. Builders help the soaps to act more quickly.

Scaps as Cleansing Agents

Scap is a good cleansing agent and is 100% budgeradable is micro-organisms present in sewage water can completely budge scap. Therefore, scaps donot cause any pollution problems. However scaps have two serious armastons.

1 Soaps cannot be used in hard water. Hard water contains certain metal ion, such as "a" and Mg. These ions react with soop to form a cordy white precipitate of calcium and magnesium salts. For example,

These precipitates stick to the fibres of the cloth as gummy mass and blocks the one by of maps to remove oil and grease from faorics. Therefore—t interferes with the — ones ig abouty of the scorp and makes the cleansing process bifficult. Hair washed with hardwater took duli because of this sticky prempitate. Dyes donot absorb evenly on cloth washed with scorp and using hard water because of this gummy mass.

2. Soaps cannot be used in acidic medium. In scidic medium, the acids present in solution precipetate the insoluble free fatty ands which adhere to the fabrics and hence mock the ability of soaps to remove on and grease from the fabrics.

Synthetic Detergents or Scapless Scaps

To overcome this difficulty, synthetic detergents have need prepared. These synthetic detergents have structures similar to scape. These are also colled scapless scape because though they behave like scape in having cleaning properties wit they do not contoin the usual scape like scalaring soits of first words. These are better cleaning agents because they do not form need the cabrum and magnesium saits with hard water. Therefore, they can be used even in hard water because they give form in the water containing innerest compounds. Some of these synthetic detergents give form even in use cold water.

These are manufactured chemically from materials other than animal factors example, these are obtained from alkyl benzene sulphonates and alkyl hydrogen sulphates. Therefore, synthetic detergents are sodium salts of long chain sulphonates and sulphates. Therefore, these are of two types

(r Sodrum salts of long chain alkylbenzene sulphonic acid. These are obtained from derivatives of beazene sulphonic and. The common examples are socium pathelengi benzenesalphonate and sodiam pa2-dodenyi benzene er aphonate.

Sodium p-(dodecyl) benzenemilphonate

Sodium p- (2-dadecyl)benzenesniphonate

(ii Sodium salts of long chain alkyl hydrogen sulphate. These are soman; salts of sulphuric acid esters of long chain a cohols containing usonly 10. 15 carbon atoms. These alcohols are obtained by the hydrogenolysis of p.,.s. and fats. For example, sodium dodecyl sulphate or sodium lauryl sulphate, sodium cetyl sulphate and sodium stearyl su phate.

CH_CH_L_CH_OSc(Ne* CH_CH__CH_OSO, Ne CH_CH__CH_ Se Ne Sodium cetyl sulphate Sodiam dodecyl sulphate Sodi an ateary, sulphate or Sodium Lauryl sulphate)

Unake ordinary soaps, these do not produce hydroxy, jons on hydrolysis and therefore, can be safely used for wooden garments.

CLASSIFICATION OF DETERGENTS

Depending t-pon the nature of surface active group. He detergents may be classified as

a amorphy of rational or we non-joing

(7 Anionic detergents)

The anionic detergents are those which contain amount hydrophilic group which is in abord in learning action. These are easily an ealth of subplicated long chain alcohols or hydrocarbons. These detergents are of two types

G. Sodium alkyl sulphates. These are obtained from long chain elcohols. containing 12-18 carbon aloma. The long chain alcohols are treated with concentrated sulphura act to from a by hydrogen sulphases of high morer dar mass and then these are netwalise | w | h alkan to form solt

The common examples of this type of detergents are sodium, surpl sulphate C. H., CH., OSO, Na* and sodium stearyl sulphate. C., H., CH., OSO, Na* For. exhip, ie,

to Sodium alkyl benzene sulphonates. These are sody an salts of long chero a kyl at iphome and a For example. sodium p≺dodecy · benzene sulphonate is prepared by treating dodecy benzene with concentrated H.SO, to form p-dodery) because an priorite and tc lowed by neutralisation with NaOH.

$$\mathsf{CH}_{\mathsf{S}}\mathsf{CH}_{\mathsf{S}_{\mathsf{A}}} \quad \mathsf{CH}_{\mathsf{S}}\mathsf{CH}_{\mathsf{S}_{\mathsf{A}}} \quad \mathsf{CH}_{\mathsf{S}}\mathsf{CH}_{\mathsf{S}} \quad \mathsf{CH}_{\mathsf{S}} \quad \mathsf{CH}_{\mathsf{S}}\mathsf{CH}_{\mathsf{S}} \quad \mathsf{CH}_{\mathsf{S}} $

Dodecylbenzene

p-Dodecylbenzenes-liphomic acid

Sodium p-dodecyl benzemesulphoneta

Sodium iauryl sulphate Amonio detergent

According Plates

The washing powders available in the market contains about 15–30% detergents by weight. The remaining part of washing powders contain other chemicals with the added to impart a other desired properties. For example.

 Sodain sulphate and sodium edicate are added to keep the weahing powder dry

(a) Sodium tripolyphosphate or someon caronasie is suded to maintain alkannity of soaps which is he pful in removing durt at also softens water

.: Carbony methyl cellulose CMC is added to washing powder to keep the dart particles suspended in we or This being the cleaning of clother.

(iv) A muit bienching agent ruch as sodium perborate is added to washing powders to produce whiteness in clothes. These are known as among detergents because the among part of the molecule is involved in the cleaning action. The most common among detergent used in household is a kyl benzene sulphonate. These among detergents are more effective in singlity acide solutions to form an alkyl hydrogen solutions which is a soluble material whereas the soaps react with the among solutions to form modulie fatty and is. Among detergents are also used in tooth pastes.

(II) Cationic detergents

The cahonic detergents have rong hydrocarbon chain with a positive charge on introgen atom rationic part which is neared in cleansing action. These are quaternary ammonium easis of amines with acetates, chlorides or brumides as snione. The common examples are cetyltrinicthyluminonium bromide, trimethylstearyl ammonium chloride, etc.

These detergents are more expensive than amount detergents. However, these possess germicidal properties to dure used quite extensively as germicides bely-trimethyl aminomian oronade is a popular cohonic detergent and is used in hair conditioners and hair shampoos.

(##) Non-ionie detergents

These detergenes donor contain any on in their constitution. These are esters of high molecular mass alcohols. However, these contain polar groups which an form hydrogen bonds with water. These are obtained by the reactions between polyethylene glycol and steams and

Н,0

CH₃, CH₂)₁₆COO(CH₁CH₀O)_a CH₀CH₂OH Pulyethylene glyculatearate Non-ronic detergent

Another example of non-load detergent a pentaerythritol monostearate

Pentuerythritu) muncelourate (mm-same detergent.

Laquid dishwashing detergents are non-some type detergents.

R U Curlous...



3 Synthetic detergents A serious problem

It may be noted that in the past, the widespread use of detergents caused pollution if rivers and other water bodies. Earlier the synthetic letergents were made from longeham of hydrocarbons having a lot of branched chains in them. These branched chain detargent mo equies were degraded very alowly oy the micro-organisms present in water bodies like lakes or rivers. Slow degradation of detergents leads to their accumulation Effluents continuing ouch detergente reach the rivers, ponds, etc. These persist in water even after sewage treatment and cause foaming in rivers. ponds, streams and thus their water geta polluted.

Cleansing action of scaps and detergents

The elecating action of scaps and detergents follows the same principle. Scaps and detergents consist of two parts

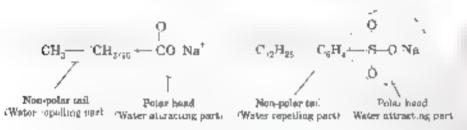
A non-polar part which consists of long chain hydrocarbon part. It is called non-polar tail. This part is insoluble in water but soluble in oil and grease. This is also called water repelling or hydrophobic part.

(i) An ionic part which consists of carboxylate ion (in case of scape) or a diphonates in sulphotes in case of detergents. This is called polar head. It is soluble in water but insoluble in on or grease. The ionic part is called water attracting or hydrophilio part.

These two parts of scaps and detergents may be represented as

Soap

Synthetic detergent



For supparity, soaps and detergents may be represented as

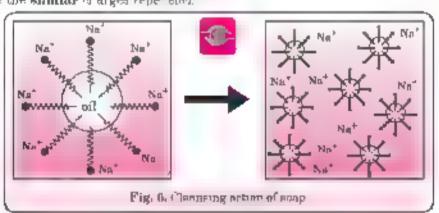
Therefore, soups and deterger to consist of a large by trocarbon tail with negatively charged head. The hydrocarbon call a hydrophobic water repelling; and negatively charged head is hydrophillic (water attracting).

The dart in the cloth is due to the presence of that particles in fat or greate which stick to the cloth. When a scap or a detergent is dissolved in water, the molecules gather together as clusters called micelles. When the dirty cloth is disped in scap in detergent some in the ton, and flust particles come in contact with each other. The non-polar tails of the scap begin to dissolve in non-polar oil or grease, while the polar hear part remains directed in water. Fig. 6. As more and more scap particles emer the grease, each fator of particles is surrounded by a number of negatively charged of de. Since the samular of arges reperience:

other, the oil or grease droplets break off into small globules of oil. These arostill surrounded by the negatively charged polar beads of the soop molecules. This prevents the small globules from coming together in form higger particles laggregates. The ribbing by hands or mechanical stirring also help to break the grease particles. In this manner, the grease particles can be completely broken up and it forms emission of grease or oil contained in dirt and water. As a result, the cloth gets free from the dirt and the droplets are washed away with water.

Therefore, they tend to remain in water bodies for a long time and make water unfil for aquatic life. For example, detergents containing phosphates can cause rapid growth of algae and therefore, deplete the dissolved oxygen present in the water of lakes and rivers. As a result of lakes of oxygen fish and other equatic animals may die

To solve these problems, nowadays, the detergents are repared from hydrocarbons which have minimum branching. These are degraded more easily than branched chain detergents. Therefore, these are biodegradoble and pose ,ess problems.



Differences between Soaps and Detergents

The main points of differences between soaps and detergents are given below

Soaps	Synthetic Detergenta	
Soops are endium on a of long chain fatty neids.	Synthes a detergrate are sodium suits of long chain alkyl sulphates or long chain alkyl benzene sulphonates.	
They cannot be used in some someons. They cannot be used in horo water as they produce products with Co ⁰⁺ and Mg ⁰⁺ ions. Scope are blodegradable. Therefore, bey do not cause any pollution problems.	They can be used even a and resolutions. They was be used even in hard water as they do not from any precipitates with Ca ⁸⁺ or Mg ²⁺ ions. Some of the synthetic detergents are not broxlegradable. Therefore, they pollute river and rake water	

Advantages of Synthetic Detergents over Scaps

Synthetic detergents are with y used as cleaning agents these days. Some of their advantages over soaps are

- Synthetic desergents can be used for washing even in hard water—in the other hand, soaps are not suitable for use with hard water.
- Synthetic belenger which be used even in neither solutions because they are not read in few tiposed in sender medium. On the other hand, scaps cannot be these in norther medium, because they are decomposed into earboxytic and a neither medium.
 - .ar) Synchetic cetergents are more sociable in water than soaps.
 - co, Symbolic detergents have a stronger cleansing action than soaps.
 - .) Some synthetic detergents give foams even in ice cold water



Conceptual Questions =

Q.1 (a) Which one of the following is a food preservative?

Equand, Morphine, Sodium benzoate.

(D.S.B. 2018)

- (b) If water contains dissolved Ca² ions, out of soaps and synthetic detergent, which will you use for cleaning clothes? (A.I.S.B. 2013)
- Ans. (a) Sodium benzasta (b)
- (b) Synthetic detergent
- Q.3. Name one synthetic sweetening agent.

(Hr. S.B. 2013.

- Ans. Sarcharut
- Q.J. Give one example of a non-tonic detergent.
- Ann. CH,(CH,),,COO(CH,CH,O),CH,CH,OH
- Q.4. Give the structure of an alkyl benzene sulphonate detergent.

(D.S.B. 2002)

Ans. Sodum p-dodecy) benzene sulphonare

CONCEPTUAL

O

Ν

C

E

Р

Т

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A

L

Q.5. What is BHA and BHT? Ans. BHA is butylated hydroxy

(Pb. S.B. 2005)

- Ans. BHA is butylated hydroxy amenic BHT is butylated hydroxy toluene Both are used as autoxidants in food.
- Q.6. What are the consequences of using non-biodegradable detergents?

(Pb. S.B. 2005)

- Ans. Non-brodegradable detergents are degraded very mowly by nauro-organisms. Therefore, they get accumulated in rivers and water ways causing water pollution.
- Q.7 Why the detergents with straight hydrocarbon groups are better than the detergents with branched chein hydrocarbon groups? (Hr. S.B. 2000)
- Ans. The detergence with strength chain hydrocarbon group are more biodegradable. han detergants with branched chain hydrocarbons. Therefore, detergents with strength chain hydrocarbons are easi. determined or protein down by unire-organisms like bacteria present in water hiddes. Therefore, they runse less water pollution and hence are better.
- Q.S. Name two artificial sweeteners used in food materials.
- Ans. (a Aspartame s., Alitama
- Q.S. Give one example each of cationic and amonic detergent.
- Ans. Cathomic detergent $\begin{bmatrix} CH_1 & CH_2 & N & CH_3 \\ CH_3 & CH_3 & CH_3 \end{bmatrix}^{\dagger}$ C): Telyloromethyl annuamum chloride CH_3

Amionio detergent : C₁₂H₂₅—SO₃Na* Sodamn p. dodecyl benzene sulphonete

Q.10. Name the awestexing agent used in the proparation of awests for a diabetic patient-

H.P S.R. 2018.

- Ans, Aspartame or seccharm
- Q.11 Why do we require artificial sweetening agents?

CBSE Sample Paper 2011)

- Ans. Artificial sweetening agents are required a notion unlike and as a substitute of sugar for diabetics.
- Q.12. Give one example for each of the following
 - (i) An artificial ewestener whose use is limited to cold drinks.
 - (iii) A non-tonio detergent,

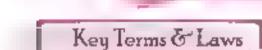
(CBSE Sample Paper 2011

- Are. If Aspertome.
 - .4 Ester of sterric and and polyethylene glyml CH, CH, aCOO(C), CH,O, CH,CH,OH
- Q.18. Among the following which one acts as a food preservative?

 Assistance, Aspiran, Sodium benzoate, Parocetamol

(A.LS.D 2018)

Ans, Sodium benzoate



- Medicines or drugs. The themself used for treatment of discusse and reducing sufferings and pani.
- Agonist. A drug which standates or activates the receptor so autists a physiologica, response is called agonist.
- Antogonist. A drug which occupies the acceptor are without producing any response is carried antagonist.

QUICK CHAPTER ROUND UP

Chemicals in Medicines

Azalgesies t	Relieve pain	Aspirio ibuprofes, diclofenar sodium amproxes, narrotice morphine codeme osrona
- Antipyreties .	Lower body temperature	Aspirio paracetamo phenocetia.
	 or preven the growth of microsegonum act heroiful for avog basues) 	Furerin soframicin dettor chioroxylenol and terpincol) 0.2% phenol
	Ki or prevent the growth of intercorganism harmful for living tunnes and can be used a non-inveng objects; clothes, flores, nicosils et	05.
1	The same substance acts as describe us distribution.	tant and anticepus e.g., 5 100 pherm is anticeptal and 1% phenoi
• Tranquibaers	Trentment of stress ments, discuses	Derivatives of barbitume acta resonant amytel, autumi seconal, chlordingsproude antercharante, valuant, seconari
Aztumorobials	Cure infectural due to introorganisms internhees	Antibustics supprenantes
 Antidertility drug 	9 : Burth control	Orac un receptives, estrogen ethysylestradiol and progesterous ourstinatelyous, intrispetature
Antiblower	Produced by mirrorganisms and ear inhibit the growth of other mirrorganisms	Penerili e stracyclon, chiorampheneni, ampanlin, amozymlin rispha druga sulphanusmide, sulphadinzme amphiguarudmes
	Peniculin Class a narrow spectrum Palacamphanical is a board spectrum	Amproulm and amoxyellon are its synthetic modifications and modifications.
Antibietamides	Anta-alsergie	Diphenhydranous benadryl bromphenousus donessy) phenomina maleste (avil), chlorophenomina maleste (seet.

Chemicals in Food

-	Pood preservatives
	Auded to foot materials
	to prevent or retard. Justin
	BDDLBCB

Common salt.

Antaoida

- Sodram senzoase
- Sodium metabusulphita
- BHA and BHT set as autroxidence

Artificial sweetening agents.

Remove excess and in stomers.

give a Weekening effect to food and enhance as a dour and rost τ

	Artificas	Sweetness value	
	menetomag	comparison to can sugar	
×	Aspertame	100	
įσ	Sereberm	560	
¥	Socrafosa	800	
p	Autabre	\$DD0	
>	\Rightarrow Use of repartame is limited to cold foods and coft drinks		

Antroxidante

Magnesium hyuromde magnesium carbonate, magnesium

tristlicate, aluminium hydroxide gel, sodium bicarbonate,

as minum phosphete renitidine cimetidine.

Prevent or record the oxidation and achievem sprainge of food

- EHA Butylated aydraxy sausole
- BHP Bubyinted hydroxy toluene)
- SO, and autposes

Cleaning Agents

· Soups

are and non or possessions as to
of higher fatty sends (16-18 C)
atoms are sents of the highest
pointersent the Court steams
and Court the Court
of the Court steams

_ .

 Bynthetic detergents are sodium salts of long chain alkyl hydrogen sulphates or long chain beazene sulphanic acies.

CH CH _oCH_OSO, No* Sodium dodewył sulphate f H, H, ₁₄ f H 38 j No Sodium cetyl sulphate

CH, CH, in Solitan p-(dodecy) benzenesulphonates

Classification based on the nature of surface active group.

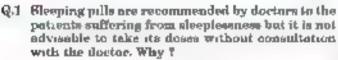
- CH, CH, SO; No CH, N CH, N CH, T

Sodium p-dodecyl benzedesulphonate Pennser-Units monotesrate





In-text Questions



CBSE Sample Paper 2011)

- Ans. Most of the drugs taken in doses higher than recommended may cause harman effects and act as poison leading to death. Therefore, a doctor must always be consulted before taking any medicine, who will advice the patient for proper and safe doses of the drug
- Q.2 With reference to which classification has this stotement "ramitidize is an antacid" been given.
- Ans. This statement refers to the classification of the drugs according to pharmacological affect of the drug. This drug runitithns as used to counteract the effect of excess said in the stomach and therefore, will be called antacid.
- Q.8. Why do we require artificial sweetening agents?
 Ans. Artificial sweetening agents are used to reduce calons intake. These also protect teeth from decaying.
- Q.4. Write the chemical equation for preparing sodium some from glyceryl plente and glyceryl palmitate. Structure of these compounds are given below in (C_uH_uCOO)_cC_iH_i Glyceryl palmitate (ii) (C_uH_uCOO)_cC_iH_i Glyceryl plente

Q.5. Following type of non-tonic detergents are present to liquid detergents, emulsifying agents and wetting agents. Label the hydrophilic and hydrophobic parts in the molecule. Identify the functional group(s) present in the molecule.

$$C_gH_{10}$$
 $O(CH_gCH_gO)_xCH_gCH_gOH$





Textbook Exercises

Q.1. Why do we need to classify drugs in different ways 7

Ann. There are a large variety of drugs for different purposes of diagnosis, prevention, relief or curs of different diseases. These have been classified according to various criteria depending upon their pharmaculogical effect, upon their action on a particular biochemical process, on the basis of their chemical structure, on the basis of molecular targets, etc. These classification have their own unefulness. For example,

Chasafication on the basis of pharmacological effect of the drugs is useful to doctors because it provides them the whole range of drugs available for the treatment of a particular type of disease

(ii) Classification or the basis of action of a particular brochemical process is useful for selecting the correct lead compound for designing the synthesis of a desired drug

scir: Classification on the basis of chemical structure helps to design the drugs having similar pharmacological activity and then selecting the drug with least truncity.

(iii) Classification on the basis of molecular targets is useful for medicinal chemists so that they can design a drug which is most effective for a particular acceptor site.

Q.3. Explain the term "target molecules or drug targets" as used in medicinal chemistry.

Ams. Drugs taken by a patient interact with macromolecules

in his proteins, carbohydrates, tipids and madeir adds

and these are called drug targets. These macromolecules

or drug targets are known to perform several rules in

the body.

The drugs are designed to interact with specific targets so that these have least chances of effecting the other targets. This minimises the side effects and localises the action of the drug

Q.5. Name the macromolecules that are chosen as drug targets.

Ass. The marramolecules which are chosen as drug targets are carbohydrates, proteins, lipids and nucleic acids

Q.4. Why should not the medicines be taken without consulting doctors?

Ans. The drugs or medicines have side effects also. In addition to normal desired therapeutar effect, drugs may also cause other effects which may be beneficial or harmful. These side effects arise because the drug may bind to mare than one type of receptor. Therefore, the doctor must be consulted to choose the right drug which has maximum affinity for a particular receptor site to have the desired effect. The doctor will also advise for the correct doses because some drugs like opintes in higher doese may act as poisous leading to serious problems and even may cause 4.

Q.5. Define the term chemotherapy. (Hr. 6.5. 2011)

Ans. The branch of chemistry which deals with the treatment of discusses using chemicals is called chemotherapy

Q.6. Which forces are involved in holding the drags to the active site of enzymes?

And. The forces holding drugs to the active sites of enzymes are hydrogen bonding, ionic bonding, dipole-dipole interactions or van der Waals interactions.

Q.7 White antacida and antiallergic drugs interfere with the function of histantines but why do these not interfere with the function of each other?

Ass. Drugs designed to cure some ailments in one organ in the body do not affect the other parts because they work in different receptors. For example, secretion of historians source allergy. It also causes acidity due to release of excessive hydrochloric acid in the stomach Since anti-allergic and aniacid drugs work on different receptors, therefore, anti-historians cure allergy who anti-ride remove andity.

Q.S. Low level of noredrenative is the cause of depression. What type of drugs are needed to care this problem 7 Name two drugs.

And. Norndressine induces a feeting of well being and helps in changing the mood. If the level of norndressine is low, then the signal sending activity of the hormone becomes tow and the person suffers from depression. In such cases, the patient needs anti-depressant drugs which which the enzymes which catalyse the degradation of noradressine The common drugs used as anti-depressant are toromand and phenetime.

Q.S. What is meant by the term "broad spectrum antibiotics"? Explain.

Ann. These are the antibotics which are effective egainst several types of harmful micro-organisms. Therefore, these are used to cure a variety of diseases. For example, chloromphenical is effective against a variety of diseases such as typhoid, acute fever diseases, whooping cough, eye infections, certain arms infections, ste. Other broad spectrum antibiotics are tetracyclins, oflowsom, etc.

Q.1b. How do antiseption differ from disinfectants? Give one example of each, (D.S.B 2011)

Ans. Antaceptes are the chemical substances which are used to either kill or prevent the growth of micro-organisms. These are not harmful to living tissues and can be safely applied on wounds, cuts, diseased skin surfaces. For example, dettal savion, fursion, soframyon, etc.

organisms but they cannot be applied on aving tissues. In other words they also tall inscroorganisms are someonly applied to mammate objects such as floor dramage system, matruments etc Some common examples of disinfectants are phenol. 26 solution), chlorine (0.2 to 0.4 ppm), etc.

Q.11. Why are classificate and ramitation better aniocida than acdrum broarbonate or magnessum or aluminum hydroxide?

Ans. If excess of sedium bicarbonete, MgiOHi, or AkOH), as used, it will make the stomech alkaline and imager the production of even more HO3 which may rause alcers in the stomech. In contrast, elimetrians and muriadine prevent the interaction of histamine with the receptor rells present in the stomech wall. This releases issuer amount of HO3.

Q.12. Name a substance which can be used so an antiseptic or well as disinfectant.

Ans. 0.2% solution of phenol acts as an antiseptic while 1% solution of phenol acts as a disinfectant

Q.18. What are main constituents of dettol ?

D.S.B. 2011)

- Are. The main constituent of dettel are chloroxylenol and corplined in a muchble solven.
- Q.14. What is tincture of rodine ? What is its use ?

 A.I.S.B. 2011:
- Ans. 2-9% indine solution of alcohol-water is ralled tincture of indine. It is a powerful antiseptic and is applied on waterds
- Q.15. What are food preservatives?
- Ans. The chemical substances which are added to the food materials to prevent their sponage and to retain their nutritive value for long periods are called food preservatives. For example, sodium benzosta, audium metabisulphira, etc.
- Q.16. Why is use of aspartame limited to cold foods and drinks?
- Area. Aspartame is initiable at enoking temperature and decomposes. Therefore, it is used as sugar substitute in cold drunks and soft drinks.
- Q.17 What are artificial sweetening agents? Give two examples.
- Ans. The chemical substances which give sweetening effect to food but donot add any calorie to our body are called artificial sweetening agents. For example, sarcharin and appartunes
- Q.18. Name the sweetening agent used in the preparation of sweet for a diabetic patient. (D.S.B. 2011)
- Ans. Any estalloral awesteoing agent such as separtame, anothers or absence may be anded
- Q.19. What problem arises in using alitame as artificial sweetener ?
- Ans. Alitame is a high potency artificial sweetening agent. Therefore, it poses a problem to control the sweetness of the food.
- Q.20. How are synthetic detergents better than soaps?
- Ans. The detergents are better than awaps because of the following ressons
 - Detergents can be used for washing even in hard water On the other hand, seeps cannot be used in hard water
 - (ii) Detergents can be used as acidir adiations because they are not readily decomposed in acidic medium. On the other hand, coupa cannot be used in acidic medium because they are decomposed into carboxylic acids in acidic medicin.
 - (ca) Detergents have a stronger elemning action than
- Q.21. Explain the following terms with suitable examples a pationic detergents able among detergents and
 - c) neutral detergents.
- Ans. (a) Catsonia detergents are those which have easume hydrophise group. These are mostly scetates chondes or bromides of quaternary ammonium salts. For example, cetyltrimethyl ammonium chlonde. (CH, H, NEH, 3)
 - b) Animaic detergents are those which have animac hydrophic group. These are manufactured from long cham almhols. For example, sodium lauryl sulphake H., H., JSO, Na.

Sodium p-(dodecyl benzene sulphonate

- c) Neutral detergents are estern of high molecular mass with fatty saids. These contain polar groups which can form hydrogen bonds with water For example, polyethylens glycol stearste CH₁(CH_{1,16}COC(CH₁CH₂O), CH₂CH₃OH
- Q.32. What are biodegradable and non-biodegradable detergents? Give one example of each.
- Ans. Detergents having straight hydrocarbon chains are easily decomposed by micro-organisms and are called bio-degradable detergents ag, suchum mary sulphate, sodium p-(dodecyl) benzens sulphonate. The detergents having branched hydrocarbon chains are not easily decomposed by micro-organisms and are called non-biodegradable detergents ag, sodium 4-1,3,5.

 7-tekramsthyloctyl] benzens sulphonate
- Q.28. Why do soaps not work in hard water ?

(D.S.B. 2011

- Ann. Hard water contains rational and magnesium soles. Therefore, in hard water soap gets precipitated as insoluble calcium and magnesium soaps which being ansoluble stick to the cloth as gummy mass and blocks the shifty of soap to remove on or grease from the cloth
- Q.24. Can you use soaps and synthetic detergents to check the hardness of water ?
- Ans. Sceps give insoluble precipitate of calcium and magnecione compo in have woter whereas description do not give precipitate. Therefore sceps but not detergents can be used to check the hardness of water.
- Q.25. Explain the elements action of scapa.

Ann. Refer Text Page 25.

- Q.26. If water contains dissolved calcium biombonate, out of scaps and synthetic detergents which one will you use for cleaning clothes?
- Ans. Calcium breathers to makes water hard. Soap will give precipitate with this hard water and therefore, can not be used for cleaning clothes. On the other hand, a synthetic detergent does not give precipitate in hard water because its calcium ealt is also suitable in water. Therefore, synthetic detergent can be used for cleaning clothes in hard water.
- Q.27. Label the hydrophilic and hydrophobic parts in the following compounds.
 - (a) CH₁(CH₁), CH₁OBO, Na³
 - (b) CH_i(CH_{i'ii}N' (CH_i)_iB_{i'}
 - (e) CH, (CH, (a COO/CH, CH, O), CH, CH, OH
- $CH_{i}CH_{j}$ Ann. (a) OSO, Na Hydrophobic Hydrophilic part pact CHACHA Nº O'F Br Hydrophobia Hydrophane port part SH, (CH,), ооосеңсьо, тата а Hydrophobic Hydrophile part. park



Exemplar Problems



Nilla

Objective Questions from Exemplar Problems are given in Competition F e page 45

35

Short finswer Type Questions -



Ann. About 100 500c.

2. Write the uses of medicines.

Ans. Medirines are used in

the point of the prevention and

at n treatment of diseases

3. What are antiseptics?

Ans. Antiseptics are chemicals which either kill or prevent the growth of microorganisms and are applied to living tissues.

4. Which type of drugs come under antimerolital drugs?

Ans. (i) Antaceptics. (ii) antibiotics and inixisoufectants.

5. Where are receptors located?

Ann. Receptors are embedded in call membrane

6. What is the burziful effect of hyperacidity?

Ans. Hyperscridity can cause alter development in stomach

7. Which sits of an enzyme is called allosteric site?

Ans. Sites different from active site of enzyme where a molecule can bind and affect the active site is collect allosteric site. Some drugs may also and at this site.

8. What type of forces are involved in binding of substrate to the active site of enzyme?

Ans. Ionic bonding, dipole-dipole interaction, hydrogen bonding, van der Waals interaction

What is the commonality between the antibiotic arephenamics and analys?

Ans. Arephenamine contains As— As linkage which resembles N — N linkages in azodyes.

10. Which class of drugs is used in sleeping pills?

Ans. Tranquilizers

 Aspiria is pain reheving antipyretic drug but can be used to prevent heart attack. Explain.

Ans. Asprin prevents pintelet rasgulation and therefore has antiblood clotting action. Therefore, asprin can prevent blood clogging at heart.

 Both antocids and antiallergic drugs are entitiviammes but they cannot replace each other-Explain why?

Ann. Both saturds and antrallergic drugs are entillustaments but they cannot replace each other because they work on different receptors.

13. What is a soft scap?

Ans. Soft scape are potassium saits of fatty acids.

14. If soap has high alkali content it irritates skin. How can the amount of excess alkali be determined? What can be the source of excess sikuli?

Subjective Questions

Ans. And-base intration can be used to determine the excess amount of alkar in soap. The excess alkal: of after aydrolysis of an can be the source of alkamany at soap.

15. Explain why some times forming is seen in river water near the place where sewage water is poured after treatment?

Ann. Detergence permet in which even after sewage areatment and therefore, cause forming in river water

16. Which category of the synthetic detergents is used in toothueste?

Ane. Amonic detergent

17. Hair shampoos belong to which class of synthetic detergent"

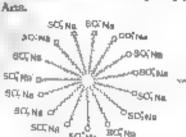
Ana, Caboon detregent

18. Dishwashing sonps are synthetic detergents. What is their chemical nature?

Asse. Non-sonic detergents

 Draw the diagram showing micelle formation by the following detergent.

CH,(CH, "CH,8O, Na.



CH₁(CH₂h₀CH₂-

20. How does the branching of hydrocarbon shain of synthetic detergents affect their biodegradability?

Ans. The detergents having use branching are degraded more easily then branched chain desergents

11. Why is it safer to use soap from the environmental point of view?

Ans. Scaps are biodegradable. The detergents are quite stable and are non-biodegradable because of branching in hydrocarbon chain hence cause water pollution. Therefore, it is safer to use soop from the environmental point of view

23. What are analgesics?

Ans. Analysis are neurologically active pain killing drugs that reduce or abolish pain without causing unpairment of consciousness, coordination mental confusion or paralysis or some other disturbances of derivous system.

29. What is the scientific explanation for the feeling of depression?

Ana. A person suffers from depression when he has low levels of noradreneline. Noradreneline is a neurotransmitter which plays a role in mood changes. Low level of noradreneline lowers the signal-sending activity and make the person suffer from depression

- 24. What is the basic difference between antiseptics and disinfectants?
- Ans. Anticeptics are applied to living tissues whereas distributions are applied to non-living objects.
 - 25. Between sodtumbydrogenearbonate and magnesium hydroxide, which is a better anticid and why?
- Ans. Magnessum hydroxids is a better antacid because it is manhable and does not allow the pH to increme above neutral. However, hydrogeneurbonate is soluble, and its excessive use can make the stomach alkaline and trugger the production of even more acid.
 - 26. Which unalgenes are called opiates?
- Ans. Narcotic analgences which are obtained from optimic poppy are called opietes. For example, morphine and its derivatives, its heroin and codeine.
- 27. What is the medicinal we of perentic deogs?
- Ans. The nercoise drugs reviews pean and produce alsope Therefore, these are commonly used for the relief of postoperative pean, cording pean and pean of terminal cancer and in child outh
- 28. What are enterometic drugs?
- Ans. Drugs which bind to the receptor site and infanit its natural function are called antagonistic drugs.
 - 29. What is the mode of action of antimicrobial drugs?
- Ans. Antimicrobial drugs can kill the interoorganism such as bacteria, virus, fungi or other parasites. They can, inhibit die padrogenic action of interotes
- What is the side product of soap industry? Give reactions showing soap formation.
- Ana, The side product is glycerol.

CH,OCOC, H₃₆ CH,OH

CHOCOC, H₃₆ + 3 NaOH → CHOH + -C, H₃ COONa

CH₄OCOC, H₃₆ CH₄OH Sod on elegants

Oil or fat Glycerol

Tracecrate By Product)

- 31. What is the difference between bathing scap and washing scape?
- Ans. Bothing scape are potassium solts of long chain faity acids while weahing scape are sodium salts of long chain faity scids.
 - 32. How are transparent soaps manufactured?
- Ans. Transparent scaps are manufactured by dissolving the scap in ethanol and then evaporating the excess solvent.
- 83 What is the advantage of using antibistamines over notacids in the treatment of acidity?
- Ans. Antacids neutralise the acid produced in the stomach. They do not control the cause of production of excess soid. Therefore, antends control only the symptoms but not the cause. On the other hand, antihustamines are the drugs which suppress the action of histomine which is the chemical responsible for stamulation of secretion of pepcin and HCl in the stomach. These influence and

- present the binding of historians with the receptors present in the stomach well resulting in lower and production and therefore, better treatment. This is the advantage of antihistorianes over anticide
- 34. What are the functions performed by histamine in the body?
- Ans. Histamnes are the potent vasodilators and performs various functions. For example, histamine contracts the smooth muscles in the broncht and gut (to which patients of authors are very sensitive) and ralaxes other muscles such as those in the walls of fine blood vessels.
 - Histamine is also responsible for the massl emgression associated with common calds, coughs, allergic response to pollens, etc.
- 35. With the help of an example explain how do tranquilizers control the feeing of depression?
- Ann. Noredreakane is a armiquidizer which induces the feeling of well being min being in changing the mood. If the rever of noredreakane is low due to certain reasons, then the aignal sending schivity of the horizone becomes low and the person suffers from depression. When autidepression drugs which inhibit the enzymes are administered, catalyse the degradation of noredrenaline. If the enzyme is inhibited, the metabolism of important neuritransmitter is slowed down and this can activate the receptor for longer periods of time and therefore, countered the effect of depression.
- 35. Why are certain drugs called enzyme inhibitors?
- Ann. Enzymes have setive artes which hind the substrate for effective and quick chemical reaction. The functional groups present at the active arte of enzyme interact with functional groups of substrate through bonding such as some bonding, hydrogen bonding, van der Wash interaction etc Some drugs interfere with this interaction by blocking the binding site of enzyme and prevent the binding of actual substrate with enzyme. This inhibits the catalytic activity of the enzyme. Therefore, these are called inhibitors
- 37. What are fillers and what role these fillers play in #08p?
- Ana. Some substances or fillers are mixed with scape to affect the properties in order to make it useful for a particular use. For example, sodium resinate, sadium carbonate, etc Sodium resinate is added in laundry scape, to increase inther and glyrerol to added in shaving scape, to prevent it from drying
- 88. Sugar is the main source of energy as it produces energy on metabolic decomposition. But these days law calorie drinks are more popular, why?
- Ans. In low colone drinks, artificial sweetening agents are present which do not metabolise and hence do not produce energy For example sucrolose These are called low calorie sweeteners
 - Fickles have a long shelf life and do not get spoiled for months, why?
- Ans. In pickles, plenty of salt and oil are added. These act as preservatives and do not allow bacteria to thrive on them.
 - 40. What is the difference between eaccharin and eaccharic acid?
- Ans. Saccharin is artificial sweetening agent and has the atmeture

Seecharia Artificia, Sweeteners

Saccharic said as obtained by the conduction of glucose with conc. HNO,.

COOH

CHOIL.

COOH

Sacetiame acid obtained from paidaviou of glucose by cone HNO.

41. Name on artificial sweetener which is derivative of socross.

Ans. Sucrolose

42. Name two 6-nmmo acids which form a dipeptide which is 100 times more sweet than cone sugar?

Ans. Aspertic seid and phenylalanme

48. Aspartame is unstable at cooking temperature. where would you suggest aspertame to be used for sweetening?

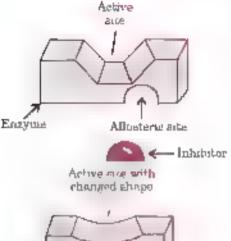
Ans. In cord foods and soft drucks

44. Sodium salts of some acids are very useful as food preservatives. Buggest a few such soids.

Ans. Benzoic and sorbic acid, propencie acid

45. Explain the role of allosteric site in enzyme mhabitaon?

Ans. Some drugs donot bind to the enzyme's active site. These bind to a different arte of enzyme which is called allosteric arts. Thus bonding of inhibitar at allosteric site changes the shape of the active site in such a way that the substrate cannot recognise it. As a result, the affinity of the substrate for the active site is reduced





ellouterne site

It may be noted that if the bond formed between enzyme. and inhibitor is strong covatent bond and therefore cannot be broken easily then the enzyme gets blocked permanently The body then degrades the ensyme unhibitor complex and synthesises new anzyme

46. How are receptor proteins located in the cell To noncline one

Ara. Receptor proteins are ambedded or cell membranes in such a way that their small park possessing active sites projects out of the surface of the membrane and opens on the outside region of the cell membrane.

47. What happens when the bond formed between an enzyme and an inhibitor is a strong covalent bond?

Ana. If the bond between an enzyme and an inhibitor is a strong covalent bond and cannot be broken easily, then the enzyme is blocked permanently. The body then degrades the enzyme inhibitor complex and synchesises the new enzyme





MEMORY TEST



Say True or False

- Equantic need as transpolitisen us a derivative of barbitance
- Phanol acts both as embsaptic and disinfactant.
- Chlorogumme is used to cure typhoid.
- Bynthetic detergents work well even in hard water.
- In cleaning action of scaps non-polar end is hydrophilin.
- Saccharine and its salts are useful for diabetic patients.
- A 1% solution of phenot is used as an antiseptic.

- Butyleted hydroxy emaole is used as artificial awartening. egeut
- Omeprazole and tanauprazole are most effective autacid.
- 10. Millopriatone to used an antifertility deag-

Complete the mussing unks

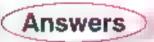
- Aspirin acta as and
- 2. Bithional is added to scape to impart them рипроизве

CHEMISTRY IN EVERYDAY LIFE

- Omerimzole is
- 4. The autiseptic dettor is a mixture of and
- **5.** Երառում ա ձ
- Penicillin was discovered by
- 7. The artificial sweetening agent sucraiose is a derivative of sucrose
- 8. **** are produced when a drug binds to more than one type of receptor
- 9. The chemical substances which prevent the allergic reactions to body are called
- 10. Chloramphenicol is a
- The birth control pills are called drups
- 12. Aniyl metacresol is

G. Choose the correct afternative

- Arsphanamine is used as entimicrobial antifertually
- A 1% solution of phenol acts as antiseptic i disinfectant
- Vallium is used as tranquilizer/antimicrobial
- The drug which stamulates or activates the receptor to unitate a physiological response is called untegonist. agonist
- 5. Ormelandene is multiportality antibiotic drug
- B. The inner part or polar part is hydrophobic i legtrophite.
- Scape are generally buildy radiable, non-budgeradable.
- BHA is antimicrobia: antiquidant in food.
- Soups/Synthetic delergents can be used even in hard
- Aspartame is georg test stable than alitame during cooking.





MEMORY TEST



Say True or False

- Foure
- 9. True
- 8. Foure
- 4 True
- 5. False. Nonpolar end behaves as hydrophobic or water repelling part
- 6. True
- Poles. It is used as a distribute.
- False. It is used as antioxidant in food products.
- 9. True.
- 10. True

Complete the missing links

- antipyretic, analysisic
- 2. mitisepho 8. unkeeld

- chiorisylenni, d-responeol
- 5. tranquilizer
- Alexander Flemming
- ancidoro.
- 8. Side effects
- autilietaunies
- broad spectrum autibiotic
- autifertuity
- 18. zubisephe

Choose the correct alternative

- anhmerchial
- 2. distofertant
- tranquilizer
- 4. agonist
- antifertility
- 6. frydrophalic
- budegradable
- synthetic detergenta.
- 2. sammingt

10. less.



Higher Order Thinking Skis



QUESTIONS WITH ANSWERS

Q.1. Amino acida serine, aspertic acid and phenylalanine are present on the active site of an enzyme. Explain which forces may be arredged in builting the drug to the enzyme if the drug inhibite the holding of substrate on the active site of carvage.

Ans. OH group of serme. COOH group of aspartic and and phenyl ring of phenylalamme help to band the drug to the enzyme.

Q.3. Why do drugs designed to cure some ailments in

one organ in the body not affect the other parts? Explain. with an example.

Ans. Drugs designed to cure some ediments in one organ in the body do not affect the other parts because they work on different receptors. For example, secretion of histamine rauses allergy. It also causes andrty due to release of excessive hydrochloric acid. in the stomech. Since antiallergic and antiand drugs work on different receptors, therefore, antihistamines cure allargy while antarida remove acidity

Q.3. Why are detergents called scapless scaps ?

Ans. The synthetic detergents have structures and all the properties similar to scape but donot contain the usual scape like sodium saits of fatty ands. Therefore, these are called sompless SDAGE

Q.4. How does aspirin help in the prevention of heart attack?

Ans. Most of the heart attacks are due to the clotting of blood in the coronory arteries. Aspurin helps to make the blood thinner and therefore, prevents the formation of blood dots to the coronary artenes. Thus, it prevents heart attacks

Q.5, Diabetic patients are advised to take artificial eweeteners instead of natural sweeteners. Explain.

Are. Diabetic patients donot produce enough mention to metabouza the natural sugar. As a result, sugar remains in the blood and affects liver, kidneys and heart. Therefore, diabetic patience are advised to take artificial sweeteners such as sawharin. It is not metabolized in the body and is excreted as each from the body without causing any damage to liver kidneys or heart

Q.6. Why are detergents non-biodegradable while soaps are blodegradable ?

Ann. Common determents have branched hydrocarbon chains. which are either not attacked or attacked only very slowly by hocterin. As a result, the detergents are not degraded in rivers and other waterways and therefore, cause water politition. On the other hand, some have unbranched hydrocarbon chains which are easily degraded by bacteria present in the sewage water and bence do not cause water pollution.



Revision Exercises



- Name one medicine which can act both as analysis and HPSB. 90 5
- What type of drug is chloromphenical? (Ph. S.B. 2000)
- Which substance is generally added to soap to impart anticeptic properties (
- 4. What are broad spectrum drope? Give one example HP S.B. 2013. Hr S.B. 2015 2018,
- Define autifertality drugs.
- Name the chemical responsible for the anthroptor properties
- Give the structural formula of aspirin. Give the RTPAC
- R. What are anti-madents? Give one example.

Hr S.B 2017

What are antihotics? Give two examples

Hr S.B. 2017 2018

10. What is the rale of bithwent in truet scape?

HPSB 2012

11. Name two artificial sweeteners used in food materials.

CH P S.B. 2018, Hr S.B. 2015.

12. Name a substance which can be used as an anticeptic as well as disinfortant

Pb. S.B. 2012, 2013, H.P. S.B. 2012, 2015, 2017

- What are antimicrohaus? (Aug an arample 167 A. S. R. 90.3)
- Give me assumpte of autoba drugs. (Assam S.B. 2015)
- 15. What is kineture of rodine and what is it used for ? Pb S.B 2018
- 16. What are analystamines? Give an example 4J K S B 2019 Pb. S.B. 2015
- 17. What are tranquilizers?

H.P. S.B. 2013, Pb. S.B. 2018, Hr. S.B. 2018

- 18. Name the aweetening agent used in the preparation of sweets for a diabetic national THP S.B. 2015.
- 19. Write the main constituents of Dattol. (Hr S.B. 2018
- What are antamide? (Pb. S.B. 2015, 2017, Hr. S.B. 2018)
- Define an assertice and disinfectants (Hr S.B. 2017)
- What are food preservativee? (Pb. 8.B. 2017)
- 28. What are artificial aweethers? (Pb. S.B. 2017)
- 24. What are analgesics? (Pb. S.B. 2017)
- What are anti-histamines? Give one example.

Jammu S B. 2018)

26. What is the purpose of adding a food preservative to a packaged food? (West Benga, S.B. 2018)

MC de from State Boards' Examinations

- Antipyretica are medicine, compounds which
 - (a) lower body temperature
 - (b) refreve pour.
 - (c) control materia
 - (d) kill interporganisme Meshwaya S.B. 2013)
- 28. 0.2% solution of phenol is no.
 - (a, antibiotie (c) diamfectant
- (b) mutaeptic
- (ർ) ക്കപ്പുരേമർ OHr S.B. 2015
- 29. Which of the following is an analysaic?
- - (a) Romitadina
- (b) Aspura
- e) Penicilin
- (c. None of these /Hr S.B 3015.
- 80. Аврити и во
 - (a) antipyretic
- (b, antibiotics
- (c) antiseptic
- (d) None of these
 - Jamma S.R 2018, 2018)
- Acetyl salicylir and is used as
 - չա, ար գրեթերեն
- an antibiobe
- (c) an analgear
- (d) a pesticide i Januna S.B. 2015.

- 82. Which is used as a preservative to protect processed food?
 - a' Sodinin enliphate
 - b Saccherin
 - e' Sodnum brearbonave
 - d Sodium metabietaphite
- 33. Dettel in casel da
 - a disinfectant
- (b) autiseptin
- c: conlgesio
- (d) anti-allergie (Hr S.B. 2015.
- 34. Penirillin ia
 - a Hornome
- (b) Antiholic
- Antisepha
- to' Lapid

tJommu S.B. 2016, H.P.S.B. 2018

- 35. Pararetamol is
 - a' antiseptio
- (b) annigent
- c antiseptic and analysis
- all authorie

Hammu S.B. 2016.

- 36. Which of the following is used as artificial sweetener?
 - a Semberia
- (b) Aspurin
- c. Omeprazole
- (d) Phenuramine (HPS.B. 2018.
- Which is not a tranquilitzer?
 - a Lummai
- (b) Seconal
- c. Yeaum
- (d) Estimonai

HPSB 2018-

- 88. Which of the following artificial awareness is methyl ester of a disentitle?
 - α Aspartame
- (b) Sucraiose
- or Onestimator
- (d) Autome

Wost Bengai S.B. 20.8.

- 39. Which of the following can be used as an antactd?
 - a Rambdine
- (b) Histanane
- c Equand
- d Asperin

Wood Bengui B.B. 2018.

- 40. The class of drugs used for the treatment of cut or wound as
 - a Tranguillizers
- (b) Antiseptics
- c) Analystamine
- off Antipyretic

Pb. S.B. 2018

Short frauer Greatien

correng 2 or 3 marks



- Write the structural formula of the following medicinal compounds
 - Apprin
 - a Paracetamol
 - eta Equanil
- What are antibiotics? Last two major classes of antibiotics with an example of each class.
- What are broad spectrum antibiotics? Name one such substance
- 4. What are antifertility drugs ? Give two examples
- Explain why we should not administer aspiran or paracetamol in empty stomach. Manipur S.B 20141
- the Define the following with two examples each.
 - a Anbiastica
- (b Antihistamines
- Tranquilizera
- Mizoram S.B. 2014

- 7 What are detergents ? Give their scheme of classification.
 Why are detergents preferred over soaps ?
- 8. What are brodegradable and non-brodegradable detergente?
 What are the consequences of using atter class of detergents?
- o) Why the detergents with strength chain hydrocarbon group are better than the detergents with branched chain hydrocarbon group?
 - b) What type of drug is phenacetin? (Hr. S.B. 2006)
- .0. What are antioxidants? What is the difference between preservatives and an automidant?

Ph.S B 2006, 2012, Januar 8.B 2016

- .1. Account for the following
 - (a Asperia drug helps in the prevention of heart strack.
 - Diabetic patients are advised to take artificial sweeteners instead of natural sweeteners.
 - c' Detergents are non-biodegradable while soaps are brouggradable. 'CBSE Sample Paper 2007.
- Explain the fallowing terms with one statable example in each case.
 - (a. Cationic detergents
 - 6 Enzymes
 - Autifertility drugs

D.S.H. 9010

- Explain the following terms with one suitable example for each
 - a) A sweetening agent for disbetic patients
 - (a) Enzymes
 - tii) Anaigezica

D.S.B. 2011

- 14. What ere the following substances? Give one example of each one of them.
 - Tranquilizers
 - (4) Food preservatives
 - (#4. Synthetic detergents

D S.B. 20, 2

- .5. (a) What is the difference between scaps and detergents?
 - b) What do you mean by food preservatives? Give names of any two food preservatives. (Jhurkhand S.E. 2013,
- .6. (a) Sleeping pills are recommended to patient suffering from sleepleasness but it is not advisable to take them without consulting the doctor. Why?
 - b) Why do we require artificial aweeting agents?

Assam S.B. 2013.

- .7 (a) Which one of the following is a food preservative? Equation Morphine. Softiam benzoete
 - b) Why is hithional added to sosp?
 - (c) Which class of drugs is used in alcoping pills?

D.S.B 20/3

 What are artificial awastening agents? Write the arrushural formula of eacharin.

Or

Explain the desnaing action of scapa

Uttarakhand S.B. 2014)

- .S. .c) What are food preservatives? Give an example
 - b) Mention a drug which can sot both as an analysis as well as an antipyretic. Name an artificial sweetening agent Kermu S.B. 3024)

- 20, .a What is the role of antioxidants in our living systems? Name one famular antioxidant.
 - b' Give the name of any one neurotransoutter

Meghataya S.B. R014'

- 31. /a Anhibiotics are classified into broad spectrum antibiotics and narrow spectrum antibiotics Write one example each for these antibiotics.
 - b. Write one simularity and one difference between antisentsu and disinfectants. (Kerola S.R. R014)
- 32. (i) What are disinfectants? Give an example
 - (ii. Give two examples of macromolecules that are chosen as drug targets
 - fin. What are amonic detergents? Give an axample

D.S.B 2014

- ft/ What are antisephos? Give an example.
 - is. Why is the use of aspartome limited to cold foods and Buff uttuks?
- 34. (b) Name the awestening agent used in the preparation of sweets for a diabetic patient
 - is. What are antibiotics? Give an example.

db.S.B. 2014

- a Give an example each of the following: 'M Artificial aweatening agents
 - (# Narcobic analgeaca th, What are cationic detergents? Give an example

(Karnataka S.B. 9018.

- 28. Define autibiotics. How do becterioidal anabiotics differ. from bactericatatos autibiotos? Give que azarople of each. Mesoram S.B. 90, 5,
- 27. a What are antibiotics? Write the name of first antibiotic diarnvered.
 - b) Give one example of an artificial sweetener used by diabetic petients.
 - c) What are antioxidents? (Meghalaya S.H. 2015)
- 28. What are synthetic detergents? Write any four ressons for which they are preferred over soaps.

Misorum S.B. 2018

What are broad spectrum and narrow spectrum antibutios? Give one example of each

Nagurand S.B. R018,

- Give me example each of the following:
 - A non-narcotic analgegic
 - An artificial awestener.
 - n. A food preservative chemical

- (a) Mention one advantage of use of synthetic detergent QUES 1970
- (b) What is kinchars of sodine? Mention one use of and are of morale Assu # 3 D 2010-
- 30. Explain the cleansing action of scap-

Hr. S.B. 2016, Negotend S.B. 2016.

- 21. .c Explus with example
 - (i. Food preservatives up Detergents
 - on an bear ed a.c. today and educated a programmed (de antaceptac es well as diamfectant

Tripara S.B. R016

- 82. (a) What is an antiseptio? Give one example
 - b Name one narootic and one non-narcotic analgeme.
 - .c) Name any two main categories of food additives Meghalaya S.B 2018)
- 33. How are antiseptics distinguished from disinfectants? Give one example of each.

- What are food additives?
- What are sutilistamines?

HPSB 2016

- 84. (f) What are tranquitzers?
 - What is imprise of jodina? Give the constituents of HP SB 2010)
- 85. (a. What are antagonist and agonist drugs?
 - b) Give one example each of bastereds, and bacteriostatic Assam S B 2018)
- 36. Give one example of each of the following: any three
 - (i) A tranquiliner
 - An autidepressent drug
 - (the Karouthe analysease
 - (iii) An autiseptio

Accom 8.B 2017)

- 87. (a) What are autacids? Name two commonly need entroid-
 - Write difference between entracptics and disinfectants. Megharaya S.B. 2018:
- 338. (i) Name a substance which can act as non-narrotic
 - a What are antichiotics? Give an example of audoutona

- (c) Why do we require artificial sweetening agents?
- What are antamide? Give one example.

Assam S.B. 2018)

- 89. Antibiotics, antiseptics and disinfectants are antimicrobial. drugs. Explain any one of these with examples Kerala S.B. 2017)
- 40. (a Define analgesics.
 - (b) Define antinyretics.
 - (c) What is tanchare of indine?

JHPS.B 2018.

- 41. (a Why are artificial sweetening agents needed? Give two exemples Januara S.B. 2018:
 - b) Describe briefly the cleansing action of soap

(Jemmu S.B. 2018, Nagotand S.B. 2018)

- 42. (a) What are druga?
 - white an example for a drug classified based on its (Kerale S.B. 2018) chemical structure.

------CESE QUESTIONS

48. Explain the following terms with one example in each case to Food preservatives

b) Erreynice

to Determente

(A.1 S.B. 2010)

44. What are analgesic drugs? How are they classified and when are they usually recommended for use?

(A.I.S.B. 9010, D.S.B. 2010).

- 45. Explain the following terms with an example for each
 - su Artalbotics (b) Anuseptics

 - (c) Analgesins

A.I.S.H. 2010)

- 46. Describe the following giving one example for each
 - .n Detergents
 - in Food preservalzyes
 - to Anthords

D.S.B. 2011 A.t.S.B 201.

- 47. What is the cause of a feeling of depression in human beings? Name a drug which can be used in treating this depression.

 A.I.S.B. 2012
- 48. .a) What class of drug is Rambdine?
 - b' If water motams dissolved Ca^{8*} most, out of scaps and synthetic detergent, which will you use for cleaning cloudes?
 - c) Which of the following is an antiseptic?

 0.2% phenol, 1% phenol (A.I.S.B. 2015)
- Give an example of artificial sweetener that could have been recommended to diabetic patients
 - a. What type of analgesics are chiefly used for the relief of pame of armanal conver A \$.8 2014

- 50. Define the following:
 - (c) Calcount datergents
 - (a) Broad spectrum antibiotics
 - or) Tranquilizers

(D.S.B. 9017 A.I.S.B 9017)

- Define the following:
 - (r) Anionic detergents
 - (ii) Narrow spectrum anabiotics
 - in Amtemala

D.S.B 2011 A 1 S B. 2017.

- 52. Define the following:
 - (r) Anionic determents
 - (ii) Lamited spectrum antibiotics
 - (it) Antiseptics

CD.S.B 2017 A.J.S.B. 2017

91. 6

36. a

- 58. (a Why is bithional added to spap?
 - (b) What is tracture of sodine? Write its one use.
 - (c) Among the following, which one sets as a food preservative?

Aspartame, Aspirio, Sodium Benzoate, Paracetamol A.I.S.B. 2018

Hints & Answers

for 1

Revision Exercises

Levy Short Answer Questions

- 1, Aspirin
- 2. Broad speatrum antibiotic
- 8. B dinonal.
- 4. Claforamphenical
- E. Chosmyletol



2-Acetrarybenzore acid

- 8. BHT BHA
- (0) It acts as antiseptic
- 11 Sorcharane, aspartame
- 13. Phenol
- 14. Sulphadiarine
- .6. Saecharine
- 19. Chioroxylegol and terpmaol
- 27, (0)
- 28. 6
- 20. (5) 80. .c.
- 32. (1)
- 88, 60
- Delli III-1
- 0.04 (27
- 34. b) 35. .b'
- 87 d 98. a 99. a 40. b

Competition File

OBJECTIVE TYPE QUESTIONS

Multiple Choice Questions





SE MULT PLE CHOICE QUESTIONS

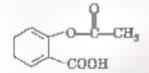
with only one correct answer

Chemicals in Medicines and Health Care

- Al. Assupyretica are medicinel compounds which
 - a) relieve para
 - lower body temperature

- se) control maiaria
- (d) kill other barniful organisms.
- A2. Aspurin ta
 - ta barbitume acid
- 61 secondi
- (c) chioroxy(eno)
- (d' acety) anhryba neid-
- AS Which of the following is not a tranquisser?
 - (a) Berbitarie seaf
- (5 Seconal
- (c) Lumma.
- d) Phenacetin.

- A4. Which of the following is not an antibiotic?
 - a Chloreniohenicol
- (5) Sulpliaduszure
- cl Pemeillin
- (d) Bithunnal
- A5, 2-Acetory bensore acid is
 - a antipeptie
- (b) untipyretic
- c) anabutan
- (d) mardeat dys
- A6. Which of the following in not an antipyretic?
 - o Parsectemo
- д Аврина
- hioramphemical
- d Phenecetan
- A7. Chioramphemool is
 - a autipyrehr
- sitgefore aurabage baced of
- (c) and dys
- (d) tranquelizer
- AS. Aspura is a
 - a necestar
- (b) antipyratio
- .c) antimalanal
- d) anticeptio.
- A9. Sulphonamides art as
 - a hypnotics
- (b) antidepressants
- c antamierobials
- о вышеериен
- A10. Progestogens and oestogens are used as
 - a antecds
- (b) antifertility drugs
- el antimierobiala
- (of) antihotics
- All Bettadryl is used as
 - ti antaseptac
- b disinfectant
- ci anvigenio
- (cf) antibustamine.
- A.2. Mdepratone is used as
 - antamerobiat
- b enconelensi
- c) antifertility drug
- (d) tranquilizer
- A.3. Which of the following can potentity be used as amagenic without causing addition and modification?
 - a Martitine
 - b) N-Acetyl parasummophenol
 - Diazenam
 - a) Tetrabydrousteool.
- A14. The following compound is used as



- a an anti-inflammatory compound
- b) analgeme
- .c hypnotic
- d) aptisepting
- A.3. Amovallar as seam-synthetic modification of
 - a penichin
- δ តៅរាមរូបសេញមូចាំរា
- .cl tetracycline
- (d) chloremphemcol.

- A16. A broad apartrum antibiotic is
 - (a) paracetamol
- .b) pentedlar
- (c) sepirin
- a" duorampheused

Chemicals in Food and Cleaning Agents

- A17. Which of the following is used as an autioxidant in foods?
 - (a, Secchara
- d. Methylated bydrary amanle
- Ormetoxifene.
- d) Cochuneal
- A18. Which of the following is used as a preservative to protect processed food 9
 - te Sodrum sulphote
- b Sarcharan
- (c) Alitama
- of) Bodium metabiaulphite
- A19. Which of the following is artaficial aweetering agenc?
 - (a) Butylated hydroxy toluene
 - (b) Alitama
 - (c) Sodium bensonle
 - (d) Teromeol
- A20. Which of the following is not an artificial awestering
 - (a) Dulem
- (b) Autome
- (c) Sorbum benzoale
- (d) Asparlame
- Which of the following is used as an autioudant in foods?
 - B Seechamp
- Methydrod hydroxy amanle.
- (c) Ormeloxifene
- (d) Auteme A22. Pick the correct statement among the following:
 - Sodium dodecylbenzene sulphonate ased in cooth paste is a cationic detergent
 - Bodium maryl sulphate forms an analuble soum with bard water
 - to. Cetyltrimethyl ammonuum brounders a popular cationic detergent used in heir conditioners
 - sd Non-some detergence are formed when polyethylene glycol ranche with adapte acid
- A28. Which among the following detergents is non-load in chameler?
 - (a) Sodřum lauryl mlphate
 - (b) Fentaerythritol stearste
 - se. Cetyltrimethyl ammonium chloride
 - (d) Sodaum n-dodecyl benzene-sulphonate
- A24. Which of the following is not a food preservative?
 - (a) Bodrum chrorida
- (b) Sodium benzonte
- (c) Bodaum stearate
- (d) Sodium metabaulphite
- A25. Which of the following is not a surfactant?
 - as CH, CH, N CH, Br
 - b CH, THOUSE, THE NOTE
 - (c) CII,- (CII,_{2/p} CII,OSO, Na⁺
 - at OHCL OH, at OH, No Ohn

MULT PLE CHOICE QUESTIONS

from competitive examinations

AIPMT & Other State Boards' Meanend Entrance

- B1. Which one of the following is employed as a cranquiliser?
 - a Naprozen
- , b Tetracyclme
- c: Chlorophemnamme (d) Eguand

CBS.E PMT 2009.

- B2. Which one of the following is employed as autilistamine?

 - a Chloromphenicol (5) Diphenylhydromine
 - c' Norothundrone
- (d' Omegrazole

A., P.M.T. 201.

- B%. Antiseptics and disinfectants either kill or prevent growth of macro-organisms. Identify which of the following statementa la ont true
 - (a) Dilute solutions of borse and and hydrogen peroxide are strong antiseptica
 - b) Disinfectants harm the aving tissues.
 - (c. A 0.3% solution of phenol is an antiseptic while 1% solution acts as a disinfectant
 - (d) . Thlomns and indine are used as atrong disinfectants. OVERT S018
- B4. Artificies aweetener which is stable under cold conditions ouly is
 - a sambarine
- (b) sucratose
- .d) alitame AIPMT 2015
- Bil. Bithiqual is generally added to the soaps as an additive to function as a 'en
 - (a) buffering agent
- (b) Antiesphin
- c softener
- d deven

47 FMT 2015

- Bo. Which of the following is an analgesic?
 - a Streptomycus
- Chapromygetan
- e Novaugan
- Personlin

NEET 2010.

- B7. Mixture of chioroxytensi and terpineor acts as
 - d, sutiseptic
- (b) antipyrete
- c aphblobe
- राजाङ्ग । इस्लाह

NEET 2017

- B8. Tinoture of rodine as
 - .a) agusous sphrism of L
 - (b) solution of L in squeous KI
 - alcoholic solution of L.
 - d) aqueous solution of KI

A.I.I.M.S. 2000.

- OCOCH. COOR B9. The compound ів цвеб па
 - (a, antiseptic
- b) engineering
- (c) sosigeese
- (al) pesticides (A.I.I.M.S. 2007)
- B10. Which of the following statements is not true?
 - (a, Some disinfectants can be used as autoseptic at new consentration.
 - Sulphediazioe in a synthetic notibecterial
 - (c) Pheromones provide chemical means of establishing CENTURAL PROPERTY IN EAST
 - (d) Aspirin is analyssic and antipyretic
 - (c) Noerthandrope is a pheromone. (Kerola P M T 2008).
- B11. Terfenadine is commonly used as a/an
 - (a. transpulizer
- (6) antibietamine
- (c) entimacrobioli
- (d') antibiotic
- se) antifertility drug
- (Kerola P M T 2011)
- B.2. Which one of the following is an antacid
 - or horograpid
- .b; Salvarsan
- Zemane
- (d Charamahemea)
- (c) Terpineol

- (Kernia P M T 2012)
- B18. Drugs that bind to the receptor site and mhibit its natural. function are called
 - (a) entegopiata
- a) agoniala
- (c) enzymes
- (d) molecular terreta

A.M.U Med 2018

- B14. The drug Tegamet 16
 - (a) snaigesia
- ,b: antidepressant
- (c) angesthetic
- (d) entacid
- (a) autibiohe
- Kerala PMT 2018
- B16. Which one of the following is a cattoric detergent?
 - (a) Sodium lauryl sulphate
 - Cetyl mmethylammanuum bromide
 - Sodrum dodecylbenzene amptimiste
 - of Glyceryl oleans

Kerara PMT 2015

JEE (Main) & Other State Boards' Engineering Entrance

- B16. Which one of the following types of drugs reduce fever?
 - (a) Antiseptics
- Antipyretics
- (c) Antihiotace
- (d) Tranquilizers

(A.I.E.E.E. 2000)

- B)7. Aspiran te known ne
 - (a) phonpl salioydate
- b) acetyl colloplate
- a methy-sobothe and of arety-sobothe and

A I E E.E 2012

- B1. (d) B2. (b) B-6. (c) B8. (c) B9. c) B3. (a) B6. (b) B8. (c) H7. (a)
- B13. (a) B14. d) B18. (b) B11. (b) B12. (c) B16. (b)

B.S. A drug that is antipyretic as well as analysis is	(c) Aspara (d) Valium
a' obligation by drochlaride	(a) Dielofenae sodium (Kernia C.E.T. 2009)
b: paracetamol	Bks. Which of the following is not an artificial sweetener?
c) chloroquin	(a) Aspartame (b) Sucrolose
d) pensellin (Karattaka C.E.T. 2009	(c) Sucross (d) Afrense
B.s. Which of the following compounds is not an antarid?	(A.M.U. Engg. 2010)
a Phenerane , b' Ramtidine	B29. The rines of druge used for the treatment of stress is
(c) Alumnum hydroxule (d) Cimetiduse	(a, snagesics & sousepine a suthistamine d resquirers
JEE Main 2015	JK.(ET 2010)
B20. Which of the following is an autonic detergent?	B80. The artificial sweetener containing chionne that has the
a Sodium stearate (5. Sodium laury) suiphate (c) Catyltriniethyl animomum brounde	appearance and taste on that of sugar and is stable at
	couking temperature is
	(a) Aspartame b) Sarcharin (c) Sucraiose (d) Autame
B21. Tanquillizers are substances used for the treatment of a cancer .b. AIDS	(a) Bithionol Kernia P E T 2010
	BSI. The entronic detorgent that is used in heir conditioners is
c' mennal diseases d) physical disorders e) blood infection	 audium dodecylbenzene aufphonate
B22. Berbituric acid is used as	(b) endican many) sulphete
	 (c) tetramethyl amanonum chlorida (d) sodium steeryl sulphate
a an antipyretic 5. an anticeptic c) an antibute .d) an analgenic	(a) cetyltrimethyl ammonium bromide
	Kernia P E T 2011
e) a tranquilizer	B32. Salts of serior seed and proprotou and are used as
·	(a) notioxidants (b) flavouring agents
	(c) food preservatives (d) nutritional supplements
o, emtipoptie (d) antipyrotec (Karnalaka C E T 2004)	(a) detergeure (Revola P E T 2011. B38. The first discovered antibiotic is
B24. Which of the following is bacteriostatic?	(a) streptomyrin (b) penreilim
a penicular .5. erythronycan	e chloramphenical of sevencycline
ci ammoglycosida (d) officarun	Odisha J.E.E. 2013
e hithonal (Kernta C E T 2006)	B34. Which of the following is antipyretic as well as
B25. Which among the following is not an anti-broke?	andgest '
a Penialia ,5 Oxytocia	(a Sulphagnanidae b' Paracetamol (c) Pencillin (d) Phenol (AM U Ragy, 2012)
c Erythromyrin d Tetroryclar	B35. Oils are liquids at room temperature made they contain
e) Officeron / Egrala P.E.T. 2008	higher percentage of
B36. Match the chemicals in column I with shear uses in	(a) pleates (b) palmitates
column II	(c) stearates (d) mynatates
Column II	Kamataka C B T 20
A. Sodunu perborata L. Dianifectani.	B96. Butylaced bydroxy toluens as a food additive acts as
B. Chiurms / II. Antiseptor	an antioxidant (6) flavouring agent
C Bithional III Mak bleaching agent	(c) rolouring agent (d) smaladier
D Poinssium sterrate IV Sonp	Karnataka (ET 2014
a A-I B-II C-III D-IV	B37 Which among the following detergents is non-some in character?
b A = H B = HI C = Iv D = I	(a Sodium laury) sulphate
c A = III B = 1 C = II. D = IV	b) Pentaerythrityl alegrate
a) $A = IV B = I, C = II D = III$ (D.C E 2009)	(c) Catyltramethyl nanununun obloride
B27. Which one among the following is not an analgesis?	(d' Sodum n-dodecyl cenzene sulphonase
z' Ibaprofea b) Naprazen	(MH-CET 2015)

B20, 6) B21, c

B81 5

Bao. c

B22. a

B83, r

B23. d

B81. 0

B24. b

B34. 5

B25, b **B26**, c'

Das, o Bas, o

B27 .d

B87 5

B18, b B19, a

B28, c B29, d

B3B. Which among the foll	lowing is a famoquilizer?	B43. Bacterindal autibiotic among the following is
a) Asparas	(b) Valum	(a) offersees (b) erythronyen
.c) Perutillin	d) Bulphanulamide	(c) chloramphenicol ,d) tetracycline
	MH-CET 2015	Karnetaka (ET 2017 B44. Pick the currect statement among the following
B89. Which of the followers		.e) Sedram dedecythenzene sulphrante used in tooth paste
(a Ofloracia	(b) Peninilin	us a cataorur determent
.c) Ammoglywades	.el) Parscetamol	 Sodum accryl sulphate forms an manighle scum with
	MH CET 2016	hard water
B40. What is the combined when they combine of	ng ratio of glyoerol and fatty acida o forou truglycende?	 (c) Cetyltranethyl ammonium bromide is a popular cationic detergent used in bair conditioner
p 8 4	P 1 5	d) Non-impo detergents are formed when polyethylene glyrol reacts with adapte acid
e . 3	d) ⊥ → MH CET 2010.	Karnataka CET 9617)
B41 Navcotar analgeer a		B45. Phendo is logist corrosive substance, due da 0.2 percent
to esperin	(b) paracetrupal	ao baan in controlo
c) codesos	(d) zentac	.a) antibotic / (b) anticeptic
e eimetidine	Kerole PET 2016)	(c) disinfectant (.d) suchistanine
B42. Which of following is	Percel or agent days	e manard Kerola PET 2017
в Единяці	6 Nepremen	B46. Borbi protes are potent
		a hypnotice b antimicrobiale
c) Tetracychn	(z/) Detiol	(c) antacida (d) antaceptics
	(Keralu PET 2016)	, (e) untacllergies (Kerala PET 2018)
Rss5 Bss. a) B40). e' B41 (e) B42 (a) B49.	(a) B14. (a) B45. (b) B16. (a)

C4 fa b

MULTIPLE CHOICE QUESTIONS with more than one correct answer

- C1. The chemicals used as analyssics are
 - а парголец
- & sulphediazine
- .c.; dirlofenac sochum.
- (d) serotomin
- C2. Which of the following are not used as antecids *
- a Magnesiam tribilicate (b Sodium bioarbonate)
- - c. Magnesium sulphote (d) Benerity.
- C3. Which of the following is/are used as antinoudants for food stuffs 2
 - a BHA

Cil. fa, e)

CB. n, e)

- , b) Sodiam sterate
- ci Autame
- (d Softum sulphite
- C4. Which of the following lawre used as artificial evectoners?
 - a Saccharan
- (b. Autome
- ci Omeprazole
- (d) Pheniramme

C8. (a, d)

- C5. Which of the following act as antihistamines?
 - (a Dimethideae
- (b) Pheniramine
- (c) Diphenhydramine
- (d) Lumina.
- Co. Which of the following is/are not derivative of barbiture acid ased as trangailizer ?
 - (a) Equand
- (b) Berotomin
- ec Seconal

Co. (a, b, c)

- d Lummai
- C7. Which of the following more not antiseptic?
 - (a, Bithianal
- (b Hydrageo perozide
- e Pethidine
- of Dantofearn sorburgo

C7 (c, d)

- C8. Which of the following are synthetic detergents?
 - eH,cH,_coochcho_chchoh
 - tor CHaCH, JacCOONa
 - e CH, H, N H, *CT
 - (a) [CH₂CH₂₄COO],Mg

Assertion Reason Type Questions

C2. (c, d)

The questions given below consist of an Assertion and the Reason. Use the following key to choose the appropriate enswer

- a. If both assertion and resson are CORRECT and resson is the correct explanation of the assertion.
- (b) If both assertion and reason are CORRECT but reason us NOT THE CORRECT explanation of the assertion.
- (c) If assertion is CORRECT but reason is INCORRECT.
- d) If assertum is INCORRECT but reason is CORRECT
- (a) If both sesertion and resson are INCORRECT

CS. (a, b)

1 6)

Competition File

1 Assertion Detergence are preferred to scape for washing Remon And gastribe a continuo allment associated with digestion Renson Detergence having branched chain by drocarbon. 6. Assertion Pheniramine is used as an antibiotic Вевион are non-brodegradable Antimicalisare asea for areatment of gastric 2. Assertion. Aspirui can cause alcer an atomach when anken 7. Assertion : empty stomach. A 0 2% solution of phenol is an antiseptic while · Solucion is a disinfectant Rensons Aspirui geta hydrolysed to asacylic acid in Instrinction - kil morroorgamems but are Remon stumerh where pH a 2 8. Assertion harmital to human assues Combinations of progesterone and exterogenare used as antifertility drugs 8. Assertion Subjan-2-codecy benzene sulphonace is a biodegradable letergens Reusson These control the pregnancy Resect Date-gents baying highly branched chains are 4. Assertion. Certain norcotice are used as analgesics. hjodagradisble. A LLM S. 2000: Reuson Nercotics lower the body temperature in high 9. Assertion Sauchamu se an artificial aweetener Remore a hos a high calorific value. 6. Assertion Pencillin ..as a narrow spectrum 10. Assertion. Asparlama is used as artificial evertener in cold deanks Reason Aspartame is stable under cold conditions.

7. 51

D. (c)

5. (b)

Matrix Match Type Quest ons

Each question contains statements given in two columns. which have to be matched. Statements in column Lare abelied as A. B. C and D whereas statements in Cotonia II are inhelled $a_{\theta} p, q, r$ and s. Match the entries of Cohumn I with appropriate entries of Column II. Each entry in Column I may have me or more than one correct option from Column II. The engineers to these questions have to be appropriately bubbled as alkatrated in the following example.

If the correct matches are A-g. A-r B-p B-s C-r C s and Dig then he correctly habbled maurix will look like the following.

	Р	q	r	8
A	P	(1)	①	(3)
В	(9)	(1)	①	(8)
¢	(P)	(g)	(i)	(B)
D	(P)	(1)	((8)

B. (c)

I Macch the drug in Column , with its type given in Column II

Calumn I	Column II	
A) Hlozecin	.p Antiseptin	
B Phenol	g Beckerodel	
(C) Tetracycline	(r) Antibiotic	
D Detat	a Charafertani	

(D) (p), (s)

Integer Type Questions

Integer Types The answer to each of the following question is a single-digit-integer ranging from 0 to 0

- The number of non-narrotic analyses is among the following: ospirin, ibuprofen, morphine, herom, dictofense sodium, paracetamal, codeine, naprozen, ipromazid
- 2. How many of the following are food preservatives? potasorum metahisulphite, aspartame, rodium benzoate. BHA, sarcharin, shitame, dalein.
- 3. The number of artificial food sweeteners among the following as abtame, butylated bydrazytolnene, sucralive, terfenadine,
- 4. The number of anotherics among the following is ampiculus, ralphrudamide, versoal, equasil, serolanus. Laminai Beconai

dulcin, cimetidme, eaccharin, aspartame, sulphadianine

9, 8

3, 6



NCERT

Exemplar Problems



Objective Questions

- Which of the following statements is not increct?
 - (a) Some antiseption can be added to scape
 - Dulute solutions of some disinfections can be used as antisepho
 - (c) Disinfertante are antinuarchial drugs.
 - d) Antisoptic medicines can be ingested
- Which is the correct statement about birth control pulls?
 - a) Contain estrogen only
 - b) Contain progesterone only
 - (c) Contain a muxture of estrogen and progesterone demyetayee
 - d) Progesterms enhances avalation.
- Which statement about aspirin is not true
 - (o) Aspirin belongs to narcotic analgence
 - (b) It is effective in relieving paid
 - (c) It has antiblood clotting action.
 - d) It is a neurologically active drug-
- 4. The most useful classification of drugs for medicinal etamata u
 - (a) on the basis of chemical structure
 - (b) on the bests of drug setton
 - (c) on the beau of molemier targets
 - d) on the bams of phermacological effect.
- Which of the following statements is correct?
- (a) Some tranquilisers function by anhibiting the enzymes. which entalyse the degradation of noradrenaline.
 - (b) Tranquilisers are narcotic druga
 - (c) Tranquilisers are chemical compounds that do not affect the measage transfer from nerve to receptor.
 - d) Trangulisers are chemical compounds that can relieve peun and fever
- Salvarsan is arsenic containing drug which was first used for the treatment of
 - a) syphilia
- (b) typhost
- (c) memogratis
- (d dynamitry
- 7 A narrow spectrum antibiotic is active against.
 - (c) gram positive er gram negative bacteria
 - (b) gram negative bacteria only
 - (c) single organism or nne disease.
 - d) both grain positive and grain negative bacteria.
- 8. The compound that causes general antidepressent action on the central nervous system belongs to the class of
 - soraegiana (n)
- (b) tranquiazera
- (c) narcolae analgesies
- (d' antihistamines
- Compound which is added to soop to impact antiseptio properties in
- - 1. (d) 8. 0 4 501 6. a 13, 15 10. c .1 6) 12, 65 14a (c) A. 10

- a sodium laurylaulphate
- 6 codrum dodecylbenzensaulphonate
- d bathroom
- 10. Equand a
 - a artificial sweetener a
- (b) tranquilizer
- enimaleufilms (a.
- all mutifertility drug
- 11. Which of the following enhances leathering property of милр?
 - a Sedium carbonate
- (b) Sodrum rosmore
- c) Sections steamete
- so Trasodium phosphale
- Glycerol is added to scop. It functions.
 - a as a filter
 - b to increase leathering
 - a su present capid drying
 - (d) to make soap granules
- 18. Which of the following is an example of liquid dishwashing determent?
 - ch_CH_(CH__, —CH_, 080, Na*
 - О-(СН₂-СН₃-О)₈--СН₂СН₄ОН
- Polyethylenegiyenia are used to the preparation of which. type of determents?
 - .a' Cationio detergenta
- (b) Anionic detergence
- c Non-come detergents
- d) Scape
- 16. Which of the following is not a target molecule for drug function in body
 - c Carbohydrates
- (b) Lipida
- .c Vitamine
- d) Protema
- 16. Which of the following statements is not true about enzyme minulmore?
 - a. Inhibit the natalytic activity of the susyme
 - b Prevent the binding of substrate.
 - c Generally a strong covalent bond is formed between an inhibitor and an enzyme
 - d) Inhibitors can be competitive or non-competitive
 - 7. (a)

- Which of the following chemicals can be added for sweetening: of food items at cooking temperature and does not provide celomes?
 - n Surrose
- (b Glucose
- .c) Aspartame
- (al) Supraiose
- 18. Which of the following will out enhance nutritions, value of food?
 - a Minerals
- (b) Artificial awesteners
- Vitemms
- d) Ammonuda



Note . In the following questions two or more options may

- 10. Which of the following statements are incorrect about receptor proteuns?
 - Majority of receptor proteins are embedded in the call.
 - .b The active site of receptor proteins opens on the inside. region of the cell.
 - .c) Chemical messengers are received at the binding sites of receptor protesns
 - (d) Shape of receptor doesn't change during attachment of messenger
- 20. Which of the following are not used as food preservatives?
 - a Table selt
- (5 Softem by drog an earbonnie
- c) Code sugar
- ab Benzona acad
- 21 Compounds with sudseptic properties ere
 - a + H 11,
 - b) CHI,
 - .c) Bone aud
 - (cf) 0.8 ppm squeous solution of Cl.,
- 32. Which of the following statements are correct about berbitalietes)
 - Hypnotics or sleep producing agents.
 - 6 These are tranquilizers.
 - Nun-nercobe analgerics
 - d Poin reducing without disturbing the persons system.
- 23. Which of the following are sulphy drugs?
 - a Suiphapyridue
- (b) Prontoeil
- e Salvarsan
- d Nurdu
- 24. Which of the following are antidepressents?
 - o Ipromazid
- b Pheneizme
- с Вопери
- d Solverson
- 25. Which of the following statements are incorrect about penimina?
 - a, An antibacterial fungue.
 - 5 Ampirillin is its synthetic modification.
 - It has bartemastauc effect
 - of it is a broad spectrum antibiotic
- 26. Which of the following compounds are adultulatered as antande?

- a Sodiam carbinate
- b Sodiam hydrogencarbonate
- Auminism sachnows.
- at Magnessum hydroxide
- 37. Amongst the following antihistamines, which are anti-ords?
 - a Ranitalane
- _ (5) Bromphengamine

- c) Terfeundme fa0 Cimetidine
- 28. Verona, and aumoral are derivatives of barbitume and which 9 те
 - a Tranquibzers
- (b Non-narcotic analgesic
- .c Antailerme drugs
- .d') Neurologically active drugs
- 29. Which of the following are amonic detergente?
 - s Sectium salts of suiphonated long chein alcohol.
 - b Ester of eteoric and and polyethylene glycol
 - c Quarternary amoromum salt of smine with scetate
 - d' Sochum salts of sulphonated rong chain hydrocarbons.
- 30. Which of the following statements are correct?
 - a Cationia detergents have reminded properties
 - b Bacteria can degrade the detergents containing highly organized chains
 - c. Some synthetic detergents can give from even in res cold water
 - d) Synthetic detergents are not scape

Sinter Match the dema given in Column I with the dema given m Calanta II

32. Metch the medicines given in Column I with their use given in Column II

Column 1	Column II
.u. Ranitadine	Tranquazer
b Furamie	a Antametic
c Phenelzme	2 Assonstamme
d) Chioramphenicol	и Аниаерые
	(e) Antifertility drug

on never smeet, drive I mon. for an never square ed. donn I work terms given to

	Column I	Colama II
	Scap chips Scap gradules	dried mininters soop butbles swell broken preces of scap formed from melted scape
C	Soap powder	 scep powder s abreaves s builders No. 3 a. No. Pt
ď	Scouring cosp	" somp powder + builders like Na, TO, and Na,PO,

19. 16. C 21 % .c. 22, July 1 28. a b 24. a b. r 18, 6 20. 0. 00 26. b), (d) 29. (a). d) 30. (a, (c), d) 25. (b). (d) 27. (a., d) 28. (a). d) of war 32, a a 5

83. Mouth structures given in Column I with the type of detergents given in Column II

Column 1	Column D
(a CH'/GH'"GOO(GH'CH'O) CH'CH'OH	(i) Cationio detergent
(6) C _n H _m COO'Nn ⁴	(#) Anuma detergent
(e) CH _p —(CH _{2'm} CH,SO' ₀ Na [†]	(act) Non-sonic detargent
Г сн,]+	
d CH₂(CH₂),a—Ñ CH₂ Br	w Soap
ĊH ₂	

34. Moved the detergence given in Column I with here uses given in Column II.

Cotuma I	Column II
Сн,]+	
□ CH₃(CH₃), N 4CH₃ Br	(,) Dishwashing powder
Сн.	
(b) CH —(CH _{sta} - \$\)—50; Na*	(ft) Laundry soap
(c) C ₁₀ H ₁₆ COONs + Nn ₂ CO ₂ + Rosin	(a) Har conditioners
SC A HAGH AND	(32) Toothpaste

Moved the class of compounds given in Column I with short functions given in Johann II.

	Column I	Содиня П		
Ľ	Autegometa	Procedurate mesage between two neurous and that between neurons to muscles		
b)	Agunists	(i) Build to the receptor aits and tohibit its natural function		
.c)	Chemical messenger	tru, Crumsi to body's ennumentestron process		
(a)	Inhibitors	(ar Minic the natural measurger		
6.0	Recuptors	al Inhibit activities of enzymes		

38. Match the classes of drugs given as Column I with their school given as Column II

	Column I	- /	Column II			
0	Anagomee			Inhibit the growth of microorganisms can be given orally		
,6)	Antiseptics	1	(n)	Treatment of stress		
c)	Antihietamines		(in)	Applied to manimate objects		
(8)	Anteods /		(cv)	Prevents the interaction of histanine with its receptor		
.e)	Tranquiliaera		(v)	Pam killing effect		
n	Antihotics		(vi)	Applied to diseased alon surfaces		
(g)	Discolectants		(pit)	Trantment of aridity		

```
38. (a, (ia) (b) (w) .c) (a) (d) (c)

84. .a (ii) , (b) (iv) , .c) (ii) , (d', ...)

85. (a, (ii) .b) ... .iv ... () ... (a) ... (b) ... .ii

86. (a) (v) (b) (vi) (c) ... (d) ... (d) ... (f) ... (f) ... (g) ...
```

> 0.1 - Resource of the Books (V) and December

Note: In the following questions a statement of american followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (a) Assertion and reason both are correct statements but reason does not explain assertion
- Assertion and reason both are correct and reason explains the assertion
- (c) Both meeriton and reason are wrong statements.
- d) Assertion is correct statement, reason is wrong statement
- (c) Assertion is wrong statement, resson as correct statement
- 87 Assertion Pancillin G is an antihistamine Reason : Penicillin G) is effective against grain positive as well as grain negative bacteria.
- Assertion Sulpha drug contain sulphonomide group.
 Reason i Salvarsan is a sulpha drug.
- Assertion i Receptors are critical to body's communication process

Reason Recepture are proteins.

- Assertion Enzymes have active after that hold substrate morecuse for a chemical reaction.
 - Reason Drugs compete with natural substrate by attaching covalently to the active site of enzyme
- Assertion. Chemics, messengers are chemicals dist enable communication of message between two neurons or between neurons and muscless.

Reason Chemicals enter the cell through receptor

 Assertion: Transparent coaps are made by dissolving scaps in ethanol Reason Ethanol makes things invisible

- Assertion : Sodium chlande is added to premistate scap after supomification
 - Reason : Hydrotysis of esters of long chain fatty scids by alkali produces soap in colloidal form
- 44. Assertion : Competitive inhibitors compete with untural substrate for their attachment on the active sites of enzymes. Reason : In competitive inhibition, inhibitor minds to the allosteric site of the enzyme
- 45. Assertion t Non-competative inhibitor minimize the catalytic activity of enzyme by binding with its active site. Reason. Non-competative inhibitor changes the shape of the active site in such a way that substrate can't recognize it.
- 40. Assertion t Chemical messenger gives message to the cell without entering the cell Resson t Chemical messenger is received at the binding

site of receptor proteins

- 47. Assertion t Receptor proteins above selectivity for one chemical messenger over the other Resson : Chemical messenger binds to the receptor site and inhabits its natural function
- Assertion All chemicals added to food cems are called food preservatives

Remon. All these chemicals increase the nauritive value of the food.

- 40. Assertion Preservatives are added to food stems

 Reacon Preservatives might the growth of normorganisms.
- 50. Assertion Artificial sweeteners are added to the food to control the intake of calonies

Reason Most of the artificial sweeteners are mert and do not metabouse in the body

87.	(c)	88 . (d)	89. (a	16. d	41. (d)	49 D	43. (6	44. c/l	45. re
4.00	430	49 64	400	10, 750	RA A				

Hints & Explanations for Difficult Objective Type Questions

B. mcq from Competitive Examinations

- B7 a Dettol is a mixture of chioroxylenol and terpineol and acts as antiseptic.
- RAS a Harrier is hectored at antibohe
- B44 c. Cetyltrimethyl ammonium bromide is enhouse detergent and has excellent germental properties and are used in hair conditioners.

NCERT Exemplar Problems MCQs Type-I

d) Antiseptics cannot be ingested.

- 3. (a) Aspirin te a non-narrotte analgeate.
- (b) Non-maid detergents are used as liquid dish washing detergents
- 16. (r Generally a weak bond such as bydrogen bonding, van der Wanla interactions is formed between the sosyme and the inhibitor



(Polymers & Chemistry in Everyday Life)

Ame allowed 2 Hrs.	Maximum Marks 36
1. Is 4NH—OHR—OO+, a homopolymer or a copolymer?	(1.
2. Write the names and structures of monomers of buna-3.	(I
3. Give one example of a neutral detergent.	(1.
4. Name a substance which can be used as disinfectant as well as an inseption	1.
5. Why is bithional added to soap?	(1,
6. What is meant by the term broad spectrum antibiotics" Explain.	2
7. What are biodegradable polymers? Give two examples.	(2)
8. What is vincamization of rubber? Discuss the main purpose of michiganion of rubber	'2
9. State the function with one example each of	(2
t. antihistamines	
a) anaigeaca	
O. Why are detergents non-brodegradable while scape are brodegradable?	42
1. Write the monomers with structures of the following polymers	
(i) Nylon 6, 6	
4 Bokebte	
na) Teflon.	(3)
2. Explain the following with examples	
0 Elestomers	
(i) Brodegradable polymera	
pri) Step growth polymerisation	(3)
3. Explain the following with example	
() Antarids	
(a) Artificial sweetening agenta	
an) Antifertility drugs.	(3)
14. a Why do drugs designed to cure adments in one organ in the body not affect the other example.	part? Exprain with an
b Low level of noradrenaune is the cause of depression. What types of drugs are needed to	o cure thus problem? 3
 Discuss the mechanism of free radical adaction polymerisation. 	3:
8. (a) How will you distinguish between	
(i) addition and condensation polymerisation	
(ii) thermopiastic and thermosetting polymers.	
.b) What are artificial sweetening agents? Give two examples.	
.c) Explain the rleanzing action of scape or detergents.	(5,

 To check your performance see HINTS AND So L. THINS TO So ME QUESTIONS at the end of Part II of the book

MOCK TEST

Strictly according to CBSE Pattern

T an ullowed 3 Hrs. Maximum Marks 70

Ger	neral Instructions	
b.	All questions are compaisary	
	Question numbers I - If one very short answer type questions corrusng I mark each	
	Question numbers 0 - 12 are short answer - ups questions co-roung 2 marks each	
	Question numbers 18 - 24 are asso short answer type questions carrying 3 marks each	
	Question annibers 25 - 27 arx ong answer type questions carrying 5 marks each	
1.	Which of the following is more stable complex and why?	
	Cotenz _a llo or (CotNH _{a el}).	(1)
9.	Why are carbohydrates generally optically active?	(1)
а.	rive an example of an artificial eweetener used by 1/2 diabetic patients	5 I 2
4.	Write the atructure of 4-methylpent-8-en-2-one.	(1)
δ.	In the ring test identification of intrate ion, what is the formula of the compound responsible for the bro	wn ring
	formed at the interface of two inquids?	(1)
Ō,	Draw the structures of the following molecules	
	.i) XeOF ₄	
	(ii) BrF,	(2)
7	Write the chemica, equations for all the steps involved in the meting of iron. Give any one method to	
	rusting of iron.	(2)
8,	A coling industrian of AgI is prepared by the following two methods	
	(a) Adding AgNO ₃ to KI ,aq) solution	
	(b) Adding KI to AgNO, ,aq. solution,	
	(i) What is the charge of coilidal particles in (a, and (b)	
	(a) Give reasons for the origin of charges.	(2)
9,	Complete the reactions	
	$I) Mg_5N_5 + H_5O \rightarrow$	
	(a) POCi ₁ + H ₂ O → / / /	(2)
	Or	
	When cone H.SO, was added into an inknown sait present in a test tube, a brown gas. A was evolv	
	gas intermised when copper towargs were also a ded into this test-tube. On cooling, the gas. As change colourless gas (B)	,(1 T) 00 V
	(a) Identify the gases A and B.	
	(h) Write the equations for the reactions involved.	
10	Complete and name the following reactions	
10,	(a) RNH ₀ + CHCl ₂ + KOH =	
	(b) RCONH ₂ + Br ₂ + NaOH \Rightarrow	(2)
11		127
11,	Define the following i) Fuel cell:	
	(ii) Limiting molar conductivity.	100
19	How are the following conversions carried out."	(2)
144	.i) Ethyl chiorde to propancic acid	
	(ii) 2-chloropropane to propan 1-ol	(2)
	(b) Introduction to head of the contract of th	4.407



- 2
- 18. (a) Why is pheno, more acidic than ethanol?
 - (b) Give chemical test to distinguish between the following
 - (2) 1 Propanol and 2-propanol (2), Phe
 - (a), Phenol and cycloheranol.

(3)

- 14, (a) Give plausible explanation for each of the following
 - (i) Why are primary amines higher boiling than tertiary amines?
 - Why are all phatic amines stronger bases than aromatic amines?

37

- (b) How will you convert p-toluidine into 2-bromo-4-methylani ine!
- 15. The following chemical reaction is occurring in an electrochemical cen-

$$Mg(s) + 2 Ag' (0.0001 M) \rightarrow Mg^{(s)} (0.10 M + 2 Ag s)$$

The Eⁿ electrode values are

 $Mg^c/Mg = 2.36 \text{ V}$

 $Ag^{*}Ag = 0.81 \text{ V}$

For this cell, calculate/write

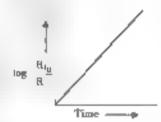
- (a) (i) Eo value for the electrode 2Ag 1/2Ag
 - (ii) Standard cell potential E°_-
- (b) Cell potential E_-.
- (c) (i) Symbolic representation of the above cell.
 - (ii) Will the above cell reaction be apontaneous?

(3)

- 16. Account for the following facts
 - (a) The reduction of a metal conde is easier if the metal formed is in figure state at the temperature of reduction
 - b) The reduction of Cr O, with Al is thermodyna inicially feasible, yet it does not occur at room temperature.
 - c) Pine oil is used in froth flotation method.

(3)

17. (a)



Answer the following nuestions to the basis of the above curve for a first order reaction A to P

- 3) What is the relation between slope of this line and rate constant?
- n) Salculate the rate constant of the above reaction if the slope is 2 x 10° s°
- b) Derive the relawonship between half afe of a first order reaction and rate constant

3+

- 18. Explain the following
 -) H_PU, and H_PU, art as good reducing agent while H_PU, does not
 - (a) All the five bonds in PCI, are not equivalent
 - (ii) Sulphur in vapour phase is paramagnetic.

(3)

19. (a) The decomposition of N_sO_sg is a first order reaction with a rate constant of $6\times10^{-6}\,\mathrm{sec^{-6}}$ at $45^{\circ}\mathrm{C}-8$

$$2N_{*}O_{*}g) \rightarrow 4NO_{*}g) + O_{*}g)$$

If initial concentration of N_4O_5 is 0.25 M, calculate its concentration after 2 min. Also calculate half life for decomposition of N_2O_5 (g



- (b) For an elementary reaction 2A + B → 9C the rate of appearance of C at time "t is 1.3 × 10" mol t = " Calculate at this time
 - (i) rate of the reaction. (ii) rate of disappearance of A.

(3)

- 20. a) Ave the number of unpaired electrons in the following complex ions on the basis of crystal field theory

 [FeF_]* and [F#CN]_**
 - (b) Name the isomerism exhibited by the following pair of coordination compounds

 [Co(NH₂), Br] SO, and [Co(NH₄), SO,] Br

 Sive one chemical test to distinguish between these two compounds.
 - (c) Draw geometrical and optical momers of [CoCl_(en., *
- 21. (a) Which will have a higher boiling point?
 1-Chloro ethane or 2-methyl-2-chlorobutane
 Give reasons
 - *b: p-natrock lombenzene indergoes nucleophies substatution faster than chiorobenzene Explair giving the resunating structures as well.
- 22. Despite having an aldebyde group.
 - (a) Glucose does not give 2,4-DNP test. What does this indicate"
 - (b) Draw the Haworth structure of α-D-(++glucopyranose)
 - (c) Give the reaction of glucose with mittee acid. / (2)

An optically active amino and A_i can exist in three forms depending on the pH of the medium. If the molecular formula of (A) is $C_iH_iNO_i$ write

- s) Structure of compound A to aqueous medium. What are such ions called?
- (a) In which medican will the catiome form of compound (A exist?)
- It alkaline laed: int towards which e extrode will the compound. A magrate in electric field?
- 28. (a) What are thermosetting and thermoplastics? Live one example in each case
 - (3) Give the monomers of Buna-S.
- 24. What are the following substances? Give one example of each of them.
 - (i) Ontionir detergenta
 - (ii) Tranquilizers
 - (6) Antihistamines (8)
- 25. At organic commutate A with molecular formula C_aH_aO gives positive DNP and odoform tests. It does not reduce Tollers on Feb. ingle reagent and loss not decolourise bromine water also. On exidation with chronic and $H_a^{-1}cO_a^{-1} = R$ resin carboxylar and B with molecular formula $C_aH_aO_a^{-1}$. Deduce the structure of A and B.
 - (b) Complete the following reactions by identifying A, B and C

$$i = A + H_o \mathcal{A}$$
 $Pd/BaSO_4 \rightarrow (CH_o \circ CH - CHO)$



27

- 26. (a) Derive the relationship between relative lowering in vapour pressure and mole fraction of the volatile liquid.
 - (b) Heptane and octane form an ideal solution at 978 K, the vapour pressures of the pure injures at this temperature are 105.2 kPa and 46.8 kPa respectively. If the solution contains 25g of heptane and 28.5 g of octane, calculate.
 - (a) vapour pressure exerted by beptane
 - (a) vapour pressure exerted by solution
 - (a): mole fraction of octane in the vapour phase.

(5)

Or.

- (a) Which aqueous solution has higher concentration. I molar or I molal solution of the same solute. Give reasons.
- (b) 1.5 g of KCI was dissolved in 100 g of water and the solution originally at z PC froze at -0.24°C. Calculate the percentage dissoriation of the anit. In, for water per 1000 g = 1.86 K.
- as In the titration of FeSO, with KMnO, in the width medium, why is dir FLSO, used instead of dir HCI?
- (b) Give reasons
 - Among transmion metals, the highest exidation state exhibited in broamons of a metal.
 - (iii) Ce⁴⁴ is used as an exidizing agent in volumetric analysis.
 - utt Transition metals form a number of interstitial compounds
 - ta. Zoo salts are white while Cust salts are blue.

Óπ

- (a) Compare the chemistry of actinoids with that of the sinchanoids with special reference to
 - electronic configuration | q | ixidation state | at one and ionic sizes
- (b) Explain the following
- Of the d* species. Or* is strongly reducing what Min III is strongly radiang.
- .) Cobalt II is stable in an order a solution, but in the presence of complexing reagents it is easily condised.

HINTS & SOLUTIONS TO UNIT PRACTICE TESTS

UNIT 10: HALOALKANES AND HALOARENES

- for CH, gCCl
- M. CHa. -CH. CH. CHa.

H_a ČH_a

2,9-Dimethylbutane

- 4. Due to Aberation of free todine
- 0. $C_iH_iCH_iC$ is a 1° arasky) halide and $C_iH_iCHCE_iH_i$ is a 2° ara kyl habite. In S. reaction, the centron proceeds through the formation of certocation. In the first step, the aralky) nalide indicases in give certocation.

The carbo arron U is anote stable than U because the ++c charge in carbos can be detocalised over two centene rings. On the other hand, the +ve charge in carboration u is detectived over only one benzene ring. Therefore, U_aH_a : $H_aCU_aH_a$ can be more ensity hydrolysed than U_aH_a : H_aCU_a in S_a term one of lowever in S_a 2 reactions, the reactivity depends upon the static andrance. Therefore, U_aH_a : U_a will get hydrolysed have easily than U_aH_a : U_a :

- 7. (i) CH,I, because I con is a better leaving group than Br
 - (a) CH,Ct because of steric hindrance in case of (CH, , CCL
- B. : 3-Brome-2-methy propene
 - (ii) 4-Bromo-4-methylpent-2-ene
- 9. Lewis ands help to generate electophile during the bronditation and chromation

The electrophile then attacks the benzene ring to form a carbocation, which issue a proton to form any, chloride or any brounds.

10. The administrates are only slightly soluble in water to order to dissolve a haloakkane in water energy is required to overcome the attractions active to the attractions active to the attractions active to the attractions between the attractions between the attractions between that and water molecules and these are not very strong as the original sydinged boar's present in water and backs the structure of baloakkanes is low.

14. •
$$CH_3CH.CL^{-alc:RPS} \rightarrow CH_3CH.C^{ag} \xrightarrow{H^*.Hg.} CH_3CH.COOH$$

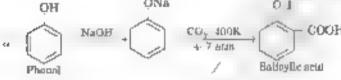
Ethyl chloride $Proponic acid$



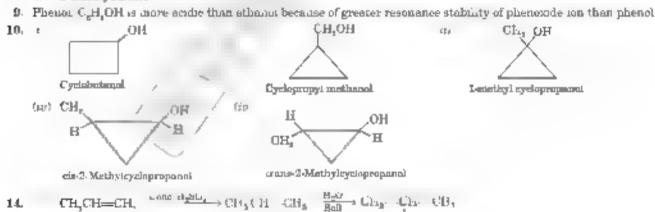
UNIT 11: ALCOHOLS, PHENOLS AND ETHERS

- ^{173 K} → CH,CH,CH,OH CH,CH,CH,OCH, + HBr. CH_Br Риоран ден Bromoniethane
- 8. To prepare distert-butyl ether by Williamson's synthesis, we require tert-out it arimone and sodium cert-butoide. Since tertbuty! brounde is a \$" alky! hands, it prefers to underno channation remark than substantion reaction. Therefore, isobacylene is obtained as the product rather than differt buty, other

- 4 o Natropheno
- 12 12 30
- -CH_o CHICHICH, Propens ONa 0.1



- * 6-Dunethylphenor
 - #1 2-Ethnoybutana



14. CH, CH=CH,
$$\stackrel{\text{cone digSL}_{\bullet}}{\longrightarrow} \text{CH}_{\bullet} \stackrel{\text{CH}_{\bullet}}{\longrightarrow} \stackrel{\text{H}_{\bullet}\mathcal{O}}{\longrightarrow} \text{Ch}_{\bullet}$$
 CH: CH: $\stackrel{\text{CH}_{\bullet}}{\Longrightarrow} \stackrel{\text{H}_{\bullet}\mathcal{O}}{\longrightarrow} \text{Ch}_{\bullet}$ CH: $\stackrel{\text{CH}_{\bullet}}{\Longrightarrow} \stackrel{\text{CH}_{\bullet}}{\Longrightarrow} \stackrel$

SOLUTIONS TO PRACTICE TESTS

$$CH^{\circ} = CH^{\circ} CH^{\circ$$

UNIT 12: ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

- 4. ap³
- 2. C.H., JC.H., < `,H.,OH < C.H.,COOH
- 8. Rosemmand's reaction.

$$G_{a}$$
 , G_{a} G_{b} $G_$

$$C_{8}H_{1}CHO \xrightarrow{H_{2}M_{1}CONHNA_{2}} C_{n}H_{n}CH=NNHCONH_{1}+H_{n}O$$
(2d) $CH_{1}COCH_{1}COOC_{2}H_{1} \xrightarrow{NaBH_{3}} CH_{3} CH - CH_{2}COOC_{2}H_{6}$
OH

- 94. Since the given compound on hydrolysis with dil. HSO, gives earboxyoo acid. B. and an alcohol. C. it must be an actor. Since the expansion of earotter. C. gives the acid. B. cherefore, both the carboxylic acid. B. and alcohol. C. must contain same number of C atoms.
 - Since ester A contains 8 carbon axioms, therefore, both carboxylin acid (B) and the airchot (C) must contain 4 (I atoms each.
 - Attohol C on dehydration gives but I are and therefore. C must be a straight chain alcohol at hatom and
 - •: B is obtained by the oxidation of 'C' and cherefore. B most be buttonian and This also suggests that the ester A must be outly butenostic. The relevant reactions are

16. *a The given compound forms '(.4-DNP derivative Therefore it is an aldehyde or ketone. Since it reduces Talien's reagent thmost he on aldehyde. The communic condergoes boundaries reaction, so indeed not constant a-hydrogen. On vigorous exide ion it gives it 2-benzonest.comboxylin acid. It means that it must be containing asky group at 2-position with respect to CHO group on the benzene ring.

- (b) butanone « Propanone « propansi « ethansi
- (c —OH group is electron reloasing group and incretors in acrosses the negative charge on the amon As a result p-hydroxy bearant and is less across than bearant and. The enhanced across of o-isomerus due to very effective increasing cultury bearant in a stabilized to a great extent and therefore it makes a result and the carboxylate ion. As a result analysis bearante ion is stabilized to a great extent and therefore it makes a resulter more analysis.

UNIT 13: ORGANIC COMPOUNDS CONTAINING NITROGEN

- L N-Bensyl-N-methylbenzenamine
- 2. p-totuiduse > amline > p-astroandine

SOLUTIONS TO PRACTICE TESTS

4. Antimes act as nucleophiles because of the presence of a tone pair of electrons on microgen

н

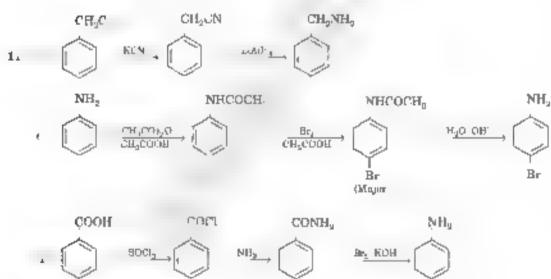
Amiline dissolves in equeous HCl due to the formation of water soluble sait.

In acctanilide, the azude group withdraws electrons from NH₂ group

As a result, the electron pair on introgen gets displaced towards carbon of group and becomes less available

Tendency to form hydrogen bonding in methylamine is less than that in methanol.

1,3.6-Trabroano benaono



12. 600 Ethylamine dissolves to water due to intermolerator Lydragen bonding as shown below

However because of large hydrophobic part + c. hydrocarbon part, of annue, the extent of hydrogen bonding is tess and therefore, aniline is insoluble in water

b Under strongly acidic conditions of intration in the presence of a mixture of conc HNO₃ + H,SO₄ and magets protonated and is converted into anticulum con having. NH₃ group. This group is descriveting group and is m-directing. So the intration of anticular gives o, p-introducing mainly p-product, while the nitration of anticulum ton gives m-introducing.

Thus intration of anime gives a substantin amount of men, many me due to protonation of amino-

Aniane soing a Lewis base reacts with Lewis and such as AICI, in farm a sait.

As a result. Not around acquires +ve charge and hence it acts as a strong deartreating group for electrophilic substitution reaction. Hence and,no does not undergo Priede) Crafts resultion

UNIT 14: BIOMOLECULES

- L. Glucose and fructose
- 2. Streptakinase
- Hydrogen bonds
- 4. Adenine and guanine
- Amylass. It hydrolyses starch into maltose
- 6. The bases of one strand of DNA are pained who bases of states strand through hydrogen bonding. The avdrogen bonding is very specific because structures of between the same only one mode of paining. The two strands of DNA are complementary to each other because, he sequence of bases in one strand automatically determines that of the other.
- 18. (b to Gluconic acid to Succharic acid (an) n-negative
- 10. (b) (c. Vitremm D.
 - (a. Vitamin B.
 - on Vitamun A.
- 12. Essential amino acids: Valine. Leurine

Non-essential ammo acids: Alanine, Glycine

UNIT 15 & 16: POLYMERS AND CHEMISTRY IN EVERYDAY LIFE

- Hommpelymer
- 1, 3 Butsdiens CH_=CH_CH=CH_ Styrene C_H_CH=CH_
- Polyethylens glycol stearsts CH, CH, aCOO(CH, CH, D), CH, CH, OH
- 0.2% solution of phenoi acts as antiseptic and its 1% solution acts as disinfectant.
- Bithionia acts as an autiseptic agent and reduces the odours produced by nectorial decomposition of organic matter on the skin.
- 6. These are the autimotus which are effective against several types of harmful micro-organisms. Therefore, these are used to cure a variety of diseases. For example, charamphenical aeffective against a variety of diseases such as typhoid, acute fever.

dysentery whooping cough eye infections, certain arine infections, etc. Other broad spectrum antibuties are astrocycline.

P. • These diminish or aboust the main actions of histomaces in the body and hence prevent the allergic reactions.

These are used to relieve pains without cousing impairment of consciousness, mental confusion, incombination or puralysis or some other disturbance of nerveou system s.e., asperio

Hazamethylenediamine 1.

H,N-(CH, /a-NH, Adapte need

- СДОН Phenol HCHO Formaldebyde Tetrafluoroethytene CP = CP
- 14. .a Drugs designed to cure some eilments in one organ in the body do not affect the atter parts because they work on different receptors. Por example, secretion of Justamine courses overgy. It also causes acutify the or release of expansive hydrochimic and in the stomach. Since animal length and antarateurigs work on different recopions, therefore, antainstomanes rure allergy while antacids remove andity
 - b. Noredreasure and see a feeting of well being and helps in changing the mond of the level of coredreasure is low then the signal sending activity of the hormone becomes low and the person suffers from depression z_0 such cases, the patient needs out-depressant drugs which athibit the enzymes which caralyse the degradation of noradrenative. The common drugs used as anti-depressant are promozid and phenetzine.

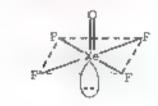
MOCK TEST

COMPLETE SOLUTION

- [Coten 4]8 because bideniate against ethylenediamine forms cholinte which is more stable
- Carbohydrates are generally optically active becouse they runtain one or more chiral atoms
- Seecharin, ortho autobateazimude)

 $H_*C \longrightarrow C \Longrightarrow CH = C$ ·CH₂

[FetH,O,,NO]SO,



Feur

Oxidetion

Reduction

 $O_{\alpha g}$ + aH^{α} aq + $4e^{\alpha}$ Overall reaction.

+ 2H.sh $2 \operatorname{Fe}(s) + O_{A}g + 4\operatorname{Hr}(ag)$ + 2Fe^{1-(ag)} + 1H, 0 (l)

Ferrous ions are exidised by storospheric oxygen to form rust

Rusting of iron can be prevented by sacrificial protection.

in this method, from is protected from rusting by covering , with a layer of a metal more active, han from This prevents ioss of electrons from from The active meta, loses electrons in preference to from and goes into loun, since Therefore the covering metal is consumed with some but as long as " is present on the surface of root the latter is not rusted

Zing is commonly used for covering from surfaces. The process of covering from with zing is an led galvenization. If some scretches occur on the protective zinc film on coated ron, even then iron will not be rusted. This is due to the fact that because of scratches, both and and and get exposed to caustion but and andergoes oxidation in preference to true. This is ac because the reduction potential of zinc \sim less, into the reduction potential of ron.

$$Z_D^{pq}(ag) + 0r$$
 $Z_D^{qq}(ag) + 0r$ $Z_D^$

Fe¹: + 2e⁻] × 2

Therefore, zinc undergose exidation in preference to iron.

- (a) (a is negative so)
 - b) us positive sol
 - The origin of charge is the selective adsorption of ions from the dispersion medians. The particles constituting the dispersed phase adsorb profession only only hose ions which are common with hear own lattice ions. For example, if silver cutrate solutions is indust the industrial salution of pubassion reduce. The silver reduce formed will adear to begin to a I lone common lone from the dispersion medium to form a negatively charged sol-

However if silver indide is formed by adding polassium todads to silver nitrate solution, the sol will be positively charged due to the adsorption of Ag' ions common ions present in the dispersion medium.

The anknown compound is some metal intrate which gives brown gas. NO. On cooling the gas changes to colouriess gas B. winch is N.O.

SOLUTION TO MIDCK TEST

10 (α RNH₂ + CHCl₃ + 8KOH + RNC + 8KCl + 8H₂O

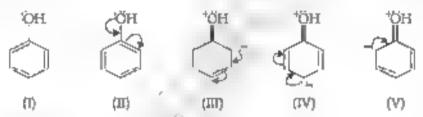
The reaction is carby amine reaction

- (b RCONH₂ + Br₂ + 4NaOH = R NH₂ + 3NaBr + Na₂CO₀ + 2H₂O It is called Hoffmann degradation reaction.
- Fuel cell. A fuel cell is a Galvanic cell in which the energy of combustion of fuels also hydrogen, methanol etc. in directly converted into electrical energy
 - The motor conductivity of a solution when the concentration approaches zero a railed limiting motor conductivity. It is expressed as A_**
- 12 CH₂CH₂C; $\xrightarrow{\text{nic KON}}$ CH₃CH₃CN $\xrightarrow{\text{H}^{*},\text{H}_{2}^{*}}$ CH₃c H₃COOH

 Ethy) chaoride Propanous acid

2-Chieropropane

.3 .a Phenol is more condic than ethanoi. The greater acrite character of phenot as compared to ethanoi can be expirated on the basis of resonance.



Similarly, the phenoside on a resonance stabilised as follows

The component of structures of phenot and phenomies no shows that three structures of nhenot. If IV and V have the charge on oxygen of OH group. This oxygen extracts the electron pair of OHH band strongly towards. Self and therefore, H can be released easily. Moreover, the phenomies so is more resonance structured than phenominate the other hand, there is no such stability in case of etheroical well as ethoride ion.

(i) Propan-2-ol gives sodoform test but propan-1-ol does not give sodoform test.

CH

Phenoi gives violet colouration with new ref. FeCl., while cycloheranol does not give violet colouration with new ref. FeCl.

.4

45

 Primary animes RNH, have two hydrogen atoms on the N moin and therefore, form intermolecular hydrogen bonding

Tertury names R₂N donot have hydrogen atoms in the N atom and therefore these donot form hydrogen bonds. As a result of hydrogen bonding to primary aromes, they have higher boiling points then tertury atomes of comparable molecular mass. For example, b.p. of a-butylamane is d51 K while that of tertury atomne is d.0 K.

Both arrismmes and otherwise are basic in nature due to the presence of one pour no Naturn Bot arrismmes are less basic than alkylamines. For example, and the is less basic than ethylamine as allown by K, values.

Ethylamins
$$K_b = 4.7 \times 10^{-6}$$

Anilme $K_b = 4.2 \times 10^{-20}$

The less basic character of and as can be explained on the basic of aromatic ring present in ambine. And no can have the following resonating structures

It is clear from the above resonating structures that three of these. III IV and V acquire some positive charge on N atom. As a result, the pair of electrons become less available, or protonation. Hence, anyone is less basic than ethyl name is which there is no such resonance.

$$\sigma = 0.81 \text{ V}$$

$$\sigma = E^* A g^* A g^* = E^* b_{1g} / M g$$

$$= 0.81 - (-2.30) = 3.17 \text{ V}$$

$$E_{ed} = E^*_{ed} - \frac{0.059}{100} \log \frac{\left[Mg^{2^+}\right]}{\left[Ag^*\right]^2} = 3.17 - \frac{0.059}{2} \log \frac{11}{(0.00)^2}$$

$$= 3.17 - \frac{0.059}{2} \times 7$$

$$= 3.47 - 0.2066 = 2.9836 \text{ V}$$

- te ta Mg so | Mg to 0.01Mb | Age 0.0001Mb Agts
 - er. Ceil reaction is spontaneous
- If a This is becomes if the metal is in liquid state his entropy is anglier than when it is an solid state. Therefore, the value of entropy change in S of the reduction process is more on two sine when the metal braids is in the liquid state and the metal braid being reduced as in solid state. As a result, the value of MG becomes more on negative side and hence the reduction becomes ensure.
 - b. The reduction of Cr_1O_2 with A_1 is thermodynamically feasible because ΔG for the reaction is negative $Cr_1O_2+2A_1 + A_1O_2+2Cr_1 \Delta G^2 = -421 \text{ kJ}$

However as we know even thermodynamically favourable reaction require some activation energy to proceed and therefore, this reaction does not occur at room temperature. Heating is required for the reaction to start

4. Pine of its added at froth Bostocus; method because it enusages the non-weithbility of the others, particles

$$b 2 \times 10^{-4} s^{-1} = \frac{h}{2 \text{ NoS}}$$

$$h = 2 \times 10^{-4} \times 2 \times 308$$

$$= 4 \times 306 \times 10^{-4} s^{-1}$$

The rate expression for first order reaction is

$$ht = 2.309 \log \frac{A_{11}}{(A)}$$

 $t = \frac{2.309}{k} \log \frac{(A_{10})}{(A)}$

Now half life period. In corresponds to time during which the annual concentration. At as reduced to bad a se-

18 α The acids of P which common P H bond are strong reducing agents. For example, both H₂PO₂ and H₂PO₃ have P H bond and hence show reducing properties.

On the other hand, H.PO, does not have P-H hand and hence does not art as reducing agent

- PCI, has trigonal bipgrammeters must be in which here are three P—CI equatorial bonds and two P—CI axia, bonds. The two axia, bonds are being repelled by two bond pairs at 90°. Therefore axia bonds are repelled more by bond pairs at 90°. Therefore axia bonds are repelled more by bond pairs than equatorial bonds and bence are larger 219 per, than equatorial bonds. 204 pm.
- In the vapour state sulphur exists as S_c molecules S_c molecule like O_c molecule has two impaired electrons in the antibonding molecular orbitals (f_c) and f_c⁺ and hence shows paramagnetism.
- 10 (a. $\theta = 6 \times 10^{-4} \text{ sec}^{-1}$ $t = 3 \text{ mm} = 2 \times 60 = 130 \text{ sec}$

$$= \frac{2.303}{8} \log \frac{|R_{10}|}{|R|}$$

$$2 \times 60 \sec = \frac{2.303}{5 \times 10^{-4}} \log \frac{0.05}{|R|}$$

$$\log \frac{0.25}{|R|} = \frac{2 \times 60 \times 6 \times 10^{-4}}{2.309} = 0.02506$$

$$\frac{0.25}{|R|} = 1.062$$

$$|R| = \frac{0.25}{1.062} = 0.235 \text{ M}$$

$$\epsilon_{02} = \frac{0.693}{5 \times 10^{-4}} = 1366 \text{ s}$$

Rate =
$$\frac{1}{3} \frac{d \cdot C}{d \cdot 1}$$

ii) Rate of reaction =
$$\frac{1}{3} \times 1.3 \times 10^{-4} = 4.33 \times 10^{-6} \text{mol } L/s^{-1}$$

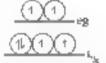
.u Buts of disappearance of
$$A = \frac{d}{dt} \frac{A}{dt}$$

$$\frac{1}{2}\frac{d[A]}{dt} = \frac{1}{3}\frac{1}{dt}\frac{C_t}{dt}$$

$$-\frac{d[A]}{dt} = \frac{2 d(C)}{3 dt}$$

$$\frac{2}{3} \times 1.4 \times 10^{-4} = 9.66 \times 10^{-6} \text{mal L} \text{ s}$$

 $=\frac{2}{3}\times 1.4\times 10^{-4}=9.66\times 10^{-6}$ mal L s' [FeF, * It is a weak field complex and Fe II has $3d^{6}$ configuration. In the weak field complex a sum the configuration of the complex is



No. of unpaired electrons = 4

[FetCN] this a strong field complex A large and has the configuration to



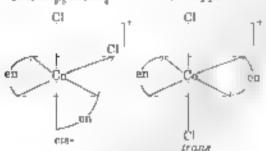
No. of ampaired electrons = 0

These are ionisation isomers. When we treat these isomers with $AgNO_g$ solution, $CorNH_g$, SO_g Brigives yellow productive which indicates that Britis outside the constitution entity $[CorNH_g]_p BrSO_g$ does not give yellow prompt at

AgNO₂ → yellow ppt of AgBr (Co(NHL), SO,, Br.

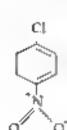
[Co(NH_a), BriSO_a — AgNO_b → No ppt

Geometrica, isomera



Optivel isomers are-form shows optice, isomers

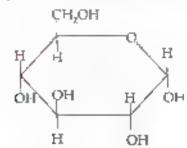
- (a) 2-methyl-2-chlorobutane has higher boiling point than 1-chloroethane because with increase in size of alkyl group. 21 boiling point mereases
 - $\Phi = NO$, group is electron withdrawing group. It activates the α -and p-positions to the balagen atom towards nucleophytic substitution reaction. This is because a withdraws electron from the benzene ring and thus facilitates are stack of the aucleophile on haloarenes. The carbamon drus formed is stanifized by resonance as shown below



Summarry the acteck at o-position is also resonance stabilized. Therefore, it makes it reactive

s.b

2 a Glucose does not give? 4-DNP test inspite of the fact that it contains—CHO group. This is because glucose does not have open about structure.



(c) Glucose gets oxidised with HNO, to give glucomo add ar secchano add

Or

In equeous medium, amino acid | CH₂CHCOOH | exists as depoint for formed by interaction of a proton from cor-

braybe seid group to ammo group as

It is called dipolar ion or switter ion.

a) In acidir medium, it exists as cetionic form

or) In sakeline medium, the compound A scripts in encome form as

Therefore, it migrate towards anode in electric field

- 23 a Thermoplestics are the polymers which can be easily softened repeatedly an heating and hardened on cooling. Therefore, these can be used again, and again. For example.
 - i) polythene (# polyvinyl chieride

Thermosetting polymers are mose which undergo permanen, dunge on heating.

They become care and infusible on desting and counct be softened again. For example,

- r) Bakebasá Malanine formaldebyde.
- b 1, 8-Butadiene CH,=CH-CH=CH, and

Styrene

24 Catzonic detergents are those which have cationic androphilic group. These are mostly acetates, chlorides or aroundes of quaternary ammonium salts.

4 Tranquillizers are substances used to relieve mental diseases. They reduce tension and anxiety. They act on higher centree of nervous system and are constituents of sleeping pills.

For example Equent.

Antihistamines are drugs used to treat allergy such as skin rashes, conjuctivities, rhands. For example. Diphenyl hydraniane.

- 3 a The given organic compound gives positive BNP test so if may be aldehyde or ketme.
 - ii) It gives positive todoform test, it should be methy, ketone.
 - on. It does not reduce Tokien's reagent or Fehling reagent it must be a ketone
 - 20 The molecular formula. C_aH₂O undicates high degree of unseturation, yet it does not decolourise Br₂ water and hence suggests the presence of unsaturation due to aromatic ring.
 - a Brestic exidation with chronic and gives a corboxyue and B with notecome formula CH₂O and it should be beinger and Therefore the compound A is mone substituted aromatic nearly betone. The molecular formula of A suggests it to be acatophenous as

$$A = \begin{array}{c} & & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & &$$

26 a Hofer Text Book

Vapour pressure of tentane ω solution = 105.2 \times 0.5 = 52.6 kPa

- (c) Vapuur pressure of octane in solution = $46.8 \times 0.5 = 23.4$ kPe Total vapour pressure of solution = 62.6 + 28.4 = 76.0 kPe
- on) Male fraction of octans in vapour phase = $\frac{23.4}{76.0}$ = 0.308
- Motor solution is more concentrated. A moler solution contains one mole of the solute present in one litre or 1000 ml. of solution. On the other hand, a mole, solution contains one mole of the solution. Olding of water. At room temperature density of water is sughity less than one so that the solution of water corresponding, a 1000 g will be greater than 1000 ml. vol = mass/density · 1. So, the volume of water containing one mole of solution will be more in case of mole, solution had moler solution. Therefore, moler solution is more concentrated, then moles solution.
- b Let us first calculate the observed motar mass as

$$\mathbf{M_B} = \frac{\mathbf{K_F} \times \mathbf{m_B} \times \mathbf{1000}}{\Delta \mathbf{T_f} \times \mathbf{w_A}}$$

$$m_{\pi} = 0.6g$$
, $m_{\Lambda} = 100g$, $\Delta T_{\rho} = 0 + i + 0.24 = 0.24$ ° $K_{\rho} = 1.80$

$$M_8 = \frac{1.98 \times 0.5 \times 1000}{6.24 \times 100} = 38.75$$

Normal motor mass of KCl = 39 + 35 5 = 74.5

Van r Hoff factor

KCi disenciates na

If it is the degree of dissociation, then

Instractionales

1

0

Moles after dissociation

1 n

. .

Total number of motes after dissociation = 1 - a + a + a = a + a

$$\frac{1+\alpha}{1} = 1.92$$
 or $1+\alpha = 1.92$
 $\alpha = 1.92 - 1 = 0.92$

or.

Degree of dissociation = 92%.

27 a This is because a part of oxygen produced from KMnO, will be used up to oxidise HCl ω Cl,

4HCl + 2[O] + 2H,O + 2Cl,

- 6 Oxomets, thus have aighest oxidation state e.g. Thus ChO. Thus an exidation state of +6 while Mn in MisO₄ has an oxidation state of +7. Thus is because of combination of metric with oxygen which is highly electronegative and outdoing element.
 - a Ce+ Ce* has E* value of I 74V which suggests that I can set as an exidising agent
 - Transition metals have a annual character to form intershiful compounds with small non-metal be elements such as hydrogen, boson carbon and introgen. The small stome of these non-metalite elements. H. S. C. N. etc. fit into the vacant spores of the lactices of the transition metal stome. As a result of the fitting up of the interstation spaces, he bransition metals become right and hard. These interstation compounds have similar chemical properties as the parent metals but have different physical properties, particularly density hardness and community for example, steel and cast from are suitdiscourse or the formation of interstates, compounds with carbon.

These interstitio compounds have variable composition and cannot be expressed by a simple formula. Therefore, these are called non-stoichiumetric compounds

Zin³ has 3d¹⁰ configure on while Cu² has 3d³ configuration. Therefore Zn² does not have vecant 3d subshell and hence is not coloured, whereas Cu² has vecan, 3d subshell and therefore electron can be promoted from t_a to a₁ orbitals by absorption of light. Hence it is blue in colour.

(h

- **Electronic** configurations. The general electronic configuration of anthanoids is $\Re e^{i4f^{1-5}} \operatorname{Ed}^{3-1} \operatorname{dis}^2$ whereas that of astimude is $\operatorname{Flui} \operatorname{Ef}^{3-1} \operatorname{Bd}^{3-1} \operatorname{7s}$. Thus, anthanoids involve the fitting of Ef -orbitals.
 - Oxidation states. Lanthanoids have principal andation state of +3 in addition the lan bandle show limited oxidation states such as +2 +3 and +4 because of large energy gap between 4f and 5a subshells. On the other manufactuoids show a large number of oxidation states because of small energy gap between 5f and 5a subshells.
 - Alomio and tonic sizes. Both landianoids and extinoids snow decrease in size of their atoms or nots in 48
 original ion state. In anthenoids the decrease is called anthenoid contraction and in each mids it is called not used
 contraction.
- E values for Cr²/Cr² is negative := 0.4. V and for Mr²/Mn is post, ve = .57V. Thus Cr² can undergo and atom and, therefore is reducing agent. On he other hand, MaxIII can undergo reduction, and therefore, acts as an oxidizing agent.
 - In the presence of complexing agents, cohelt gets exidised from +2 to +3 state because Cotff is noire stable than Cotff

APPENDICES

- A. Important Name Reactions
- B. Distinction between Some Pairs of Organic Compounds (Chemical Tests)
- C. Organic Conversions
- D. Problems Based upon Organic Reactions

APPENDIX A

Important Name Reactions

1 Aldol condensation

Two molecules of a dehydes or ketones containing α hydrogen atom. In the presence of dilute a ka \dot{a} di. NaOH ButOH $_{o}$ etc. and test condensation to form β -hydroxy ardehydes of ρ -hydroxyketones.

Two molecules of ethanal

Two molecules of propagal

$$CH'CH^3CH = C$$
 $C = 0$

Please note this reaction. The second molecule some only from a-carbon alom.

Two molecules of propanone

4-Hydraxy-4- methyl-Pencan-2-me Diacetinos alcobol

6-Methylpent-9-en-2-one (mesityl oxide)

Formataehyde and benzalde wile witch do not have a-hydrogen atom do not undergo tidol condinsation

2 Bacyer Villiger Oxidation of Ketones

Retonos react with peroxy acid to form esters. In this reaction, the oxygen from the peroxy acid is inserted. between the carbonyl group and one of the acadehed carbons of the Reconstic give an **ester**

1 Benzoin condensation

Two modern is of aromatic a dehydes, such as benzaidehyde, on heating in the presence of ethanolic KCN get condensed to form **benzom**,

APPENDICES

4 Bouveault Blane reaction

Esters are reduced by sodaum in alcohol to primary alcohola.

$$CH_{g}COOC_{g}H_{g}$$
 $N_{0}, C_{g}H_{g}AR \rightarrow 2CH_{g}CH_{g}OH$
Ethanol:

Ethanol:

Balz-Schiemann reaction

This reaction involves the decomposition of diazonium fluoriborate to aryl fluorides.

6 Cannissara reaction

Adebydes which do not contain any a-hydrogen atom e.g. benzaid: byde, formaldebyde, undergo self exidation and reduction reaction in the atmen, with concession of easitic likal. In this reaction, me molecule is concised to acid while another molecule is reduced to alcohol.

7 Carbyiomine reaction

When a primary amine an phatic or aromatics is warmed with charoform and alcoholic KOH at forms an assoyanide or carbytamine having extremely offensive smell.

8 Claisen condensation

It involves self-contions also of two molecules of ester containing a-hydrogen in the presence of a strong base such as sodium ethnoide to form β -keto ester

Ð

2 Clemmensen reduction

It rove yes the reduction of a dehydes and ketones to the corresponding hydrocarbons with amangamated zinc and cone. HCL

$$CH_aCHO + 4H$$
 $\frac{Za_1Hg}{some HG1}$ $CH_aCH_a + H_2O$
Acetaidehyde Ethane

18 Coupling reaction

The reaction of diazonium saits with phenois and aromatic amines to form azo compounds. The reaction is carried out in ice cold solution

Methyl orange which acts as an indicator in the and a karmona is obtained by coupling the diagonium sait of p aminosodrambenzene surphonate with N N-dimethyl antine in the presence of atkair.

$$Na_{03}S \longrightarrow NH_{2}$$
 $P-Amino sodiumbenzeno sulphonats$
 $Na_{03}S \longrightarrow N_{2}C$
 $Na_{03}S \longrightarrow N_$

11 Diazotisation reaction

The formation of diazonium sait from primary amine in a dilute numeral acid. HCl or H_2SO_4 and treatment with rold solution of introde acid. N. N. $h_a+\mu$. HCl at 273–276K.

$$NH_2$$
 $N = NC$
 $+ 2H_4O$

And the Measure distribution chief de

12 Dicla-Alder reaction

Œ

The reaction between α, β-unsaturated carbonyl compound and a conjugated diene to form an addition product is known as Diels-Alder reaction. This reaction is also known as **cyclo addition.**

13 Etard's reaction

The paralate r of p0 some to be a zaide hyde with chromy chronide r0 r0. r0. r0 dissolved in CC $_{\phi}$ or CS $_{\phi}$

14 Esterification reaction

The reaction of alcohols with carboxylic acids to the presence of a few drops of conc. $H_0 SO_4$ to form esters

It may be noted that IHC_1 gas is used as a catalyst in the above reaction, the reaction is known as **Fischer-Speier** esterification.

16 Elb's reaction

The exidation of phenoliny potoses ampersulphate $K_2S_*O_8$ in alkaline medium to form a maxture of catecholand p-quinnt.

16 Exhaustive alkylation

The process of converting on amine 1, 2° or 3, into its quaternary aminon amisalt in frequencial with excess of they halide is called exhaustic alkytomer. If alky halide is morthyl on, de, the process is called **exhaustive methylation.**

17 Fittig's reaction

This reaction is a modification of the Wurtz reaction. In this reaction, two moterules of haloarene combine with metallic sodium in the presence of anhydrous ether to give dipheny.

18 Finkelatein reaction

Chimonikanes or hrumsnikanes are converted into carresponding indonikanes by treating with sodium incide dissolved in scetone.

19 Friedel Craft's alkylation

Benzene and other aromatic compounds mart with altyl halides in the presence of anhydrous AlCl₂ to form alkyl brozen. This reaction involves the addition of alkyl. Righting to the brozen rule.

The alkylation of between can have be carried with proprine in the prosener of phosphoric acid—as the catalyst when the product formed is isopropyl between

28 Priedel Craft's acylation

Benzene and other aromatic compounds react with and chlorides at anhydrides in the presence of anhydrous AC , in form setones. This reaction involves the addition of any RCO- group

21 Fries rearrangement

The concerning or marriagement of an anyl ester into a- and p-hydroxy kettine or a mixture of both by treatment with anhydrous AlCla

Gabriel phthalimide synthesis

This reaction is used to propage primary amines. In the smartton phthat, mide is converted into its potassic at salt by treating with accounts solution of RLH. The salt is then treated with ackyl hande to give N-ackylphthat mide, which on hydrolysis with dilute hydrocharic acid gives a primary amine as the product

23 Gattermann reaction

This is a modification of Sandmeyer's reaction. This involves the maintain of benzene diazon; an chloride was Cu/HCl and Cu/HBr to prepare chloridenzene and bromobenzene respectively.

24 Gattermann Kach reaction

Henzene is renewrited to be realderly de by passing a mixture of earbon monoside and hydrochiome and gas in the presence of anhydrous ArCl_s and traces of coprous chiomide

This reaction is, thus, a modification to the Friedel-Craft maction, a which —CHO group is atroduced in the benzene ring.

25 Haloform reaction

The compounds containing methyl group bonded as earbonyl group |e| methyl ketones $CH_3CO|$ or the compounds which can be converted to methyl ketones upon oxidation |e|g| $|CH_3|$ CH react with aqueous sodium

OH 'bys reaction is also co

carbonete and rodine solution and give yellow precipitates of rodoform. This reaction is also called rodoform reaction

$$CH_{3}CH_{2}OH + 4I_{4} + 6NaOH \rightarrow CHI_{5} + HCOON_{8} + 5NaI + 5H_{2}O$$

Ethanol Iodoform

This reartion is commonly used to distinguish between methyl astones or methyl carbinois from ether ketones and alcohous

26 Hell Voluerd Zelinsky reaction

Butan-2-one

The biliphatic carboxylin acids containing why drogen react with Cl, or Br, in the prosence of a small amount of red phosphorus to give of haloacids. With excess of halogen, all the unhydrogen atoms of the aliphatic corboxy is acids are replaced by halogen atoms.

The ot-hanger in the reaction can be replaced by other groups such as OH, CN NH₀, COOH, etc. by so table reagents.

27 Hoffmann bromamide reaction

The anndes can be converted one primary animes convening one farbon atom less than the original are deby heating with a mixture of Br_g in the presence of NiOH or NOH. This reaction is a sales set Hoffmann's degradation reaction.

The reaction is very useful to convert a higher member in a family to its next lower member.

28 Hoffmann elimination reaction

This is the pyrolysis of qualernary ammonium hydroxide which contains one alky, group other than methyto give alkeno.

29 Hoffmann mustard oil reaction

When a mixture of promote carbon distribute and mercuro chionde is heated, alkyl isothiocyana e with a characteristic smell of mustard out is formed.

80 Hunsdiecker reaction

Alky, bandes are prepared by decomposing the silver saits of carboxy, c and silved in CC_4 by bromine or objective

$$CH_0COOAg + Br_2$$
 $CH_0Br + CO_2 + AgBr$
Silver sectute $Methyl \ bromide$

H Hydrohorntion reaction

This reaction involves add tinn of wover to a double bond opposite to that of Markovnikov reaction. The reaction cakes place by addition of borane BH_z is lowed by hydrolysis to alcohol.

$$\begin{array}{ll} \mathrm{CH_3CH} = \mathrm{CH_0} & \xrightarrow{\mathrm{BH_3}} & \mathrm{CH_3CH_2CH_2B} & \xrightarrow{\mathrm{BANy}} & \mathrm{3CH_3CH_2CH_3OH} \\ \mathrm{Propens} & \end{array}$$

or
$$CH_3CH = CH_4$$
 $\frac{4^{\circ} BH_0, THP}{(H_1H_0O_0, CH)} \rightarrow 3CH_3CH_2CH_2OH$

12 Kolbe's electrolysis reaction

The electrolysis of sode am or potassion sait of a carboxylic acid in equebox at the gives alkane at went in alkyne as the product depending upon the nature of the carboxy in acid used. For example,

. Ethane is prepared by the electrolysis of aqueous potassium acut in

At anote
$$2CH_3COO = \xrightarrow{-4c'} 2CH_3COO \rightarrow CH_3CH_3 + 2CO_2$$

Ethane

At cutmide. Both K* and H* ions, obtained by the electrolysis of water, will be formed out H* ions are preferentially discharged due to the lesser discharge potential of hydrogen.

$$9H^+ + 2e^- \longrightarrow 2H \text{ or } H_q$$

. Ethene can be obtained by the electrolysis of actieous solution of the potassium sait of success clack

A Ethyne can also be obtained by the electrolysis of aqueous solution of potassium maleate

83 Kolbe's-Schmitt reaction

Sodium phenomics reacts with CO₂ under pressure (6 - 7 atm at 400K to form sodium cancellate which upon acidification with HCl gives sancyles acid.

81 Knoevenagel reaction

Adebydes react with compounds containing active methylene group in the presence of organic bases and form or prosecutated pends.

85 Labermann nitroso reaction

Bota a, pind, r and aromer a secondary ammes react with incroassant. NaNO₂ + d. Hf. to give in research which are generally years only compounds and are instituted in mineral acids.

The intrisonment in warroing with a crystal of phenol and a few drops of concentrated so phone acid gives a green solution which upon treatment with aqueous alkali solution changes to deep him. This reaction is used as a cost to distinguish screeders on these from primary and techniques have

16 Lederer-Mannasse reaction

Phenoi condenses with aliphatic or aromatic eldehydes in the ρ - and ρ -positions. For example, phenol undergoes condensation with formatin (40% aqueous formaldehyde, at low temperature to form ρ -hydroxy benzyl alcohol

This reaction is the basis of preparation of bakelite

97 Mendius reaction

The asky or ary cyanide is reduced to a primary sinine with nascent hydrogen produced by the action of sodrain amangam and alcohol.

Uxymercuration and demercuration of alkenes

Alk ness react with the marie area as it is main, an of THF and water to give hydroxyalkyl thereary compound tovolving addition of OH and HgOAc to the doubte bond. These selected Oxymerouration. Then NaBH, reduces—HgOAc and replaces with hydrogen. This is democretarion.



89 Perkin's reaction

Benzaldehyde on heating with acetic anhydride in the presence of sodium acetate, and the hydrolysis of the product obtained gives u, \$\beta\text{-unsaturated acid, cinnamic acid}\$

$$C_{6}H_{6}CH \circ O + H_{2}CHCO \qquad C_{6}H_{6}CH \circ CHCO + CH_{2}COOH + CH$$

48 Rosenmund's reaction

And chiorides are converted to corresponding judebydes by causivite reduction. The reaction is carried our by passing through a hot solution of the and chioride in the presence of passadium deposited over barium surphate partially possoned with autiphar or quinounes.

The poisoning of pictatium catalyst decreases its articles and it does not allow the further reduction of aldehyde into alcohol.

Romer Tiemann reaction

Phenola react with chloroform to the presence of squeous alkal- at 340 K. The hydrolysis of the resulting product gives 2-hydroxybenzaldohyde (salicylaidehyde).

In this reaction, a small amount of p-hydroxy benza, dehyde is also formed. If instead if chiaroform, is, rhor—tractionide is used safety in acid is formed.

A small amount of p-hydroxy benzoic and will also be formed.

Sabatter and Sendern's reaction

Unsaturated hydrorarbone are reduced to saturated hydrocarbons with hydrogen in the presence of Rancy makel as catalyst at 473-573 K.

43 Sandmeyer's reaction

Benzone anizon: melt oride is converted to chlorobenzene bromobenzene eyanaoenzene is treatment with CuC/HCl, CuBr/HBr and CuCN/KCN respectively

44 Schiemann reaction

Fluoronetzene is prepared from benzene diazon: i.e. elser-ac by treating with fluoroboric and and heating the product formed

45 Schotten Baumann reaction

The reaction involves the benzoy at his of phenoi, primary or secondary amine with benzoy, chande in the presence of equeous sodium hydroxide.

Stephen's reaction

The part a reduction if alkyl many evan desto the correspondent aldomydes with a suspension of anhydrous SnC_{2} in other saturated with HC_{1} at room temperature followed by hydrolysis.

$$SnCi_2 + 2HCl \longrightarrow SnCl_4 + 2H$$

$$Noscent$$

$$CH_2 - C = N + 2(H + 2HC) \qquad + CH_2CF = NH HC \qquad + \frac{h_{11} - h_{01}}{A_{contail densities}} \qquad + CH_3CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{01}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{12}}{A_{contail densities}} \qquad + C_8H_5CH = NH HC' \qquad + \frac{h_{12} - h_{12}}{A_{contail densities}} \qquad + C_8H_5C$$

D

47 Strecker's synthesis

The reaction involves the conversion of an aldebyde to an G-amino acid with one more carbon atom

$$CH_3$$
 $C=0$ $\xrightarrow{Nat,N}$ CH_3 $CHC=N$ $\xrightarrow{B^*}$ $\xrightarrow{H_2O}$ CH_3 $CHCOOH$ CH_3 $CHCOOH$ CH_4 $CHCOOH$ CH_5 CH_6 $CHCOOH$ CH

48 Transesterification

When an ester is treated with excess of another alcohol other than one from which ester is formed in the presence of a lase such as the corresponding sodium or polassism allowaters, an acid H_2SO_4 or HCI as catalysts, a new ester and a new alcohol is formed

40 Ulmann reaction

€.8

Iodobenzene is heated with copper powder in a sessed tube forming diphenyl.

50 Tischenko reaction

At aid; ydes car be made to undergo Carmizzaro's reaction with all own am ethoxide. Under these conditions the acid and the acidnol combine to form ester and the reaction is known as Tischenka reaction.

51 Wittig reaction

Adehydes and ketones react with phosphuranes or phosphorous vides to give alkenes and triphenyphosphage exide

Williamson synthesis

This reaction is used to prepare both symmetrical and unsymmetrical ethers by treating alky, haide with either sodium alkot de or sodium phenomide

Ary, halides cannot be used for the preparation of alky, ary, others because of their low reactivity

88 Wurtz reaction

Asky, handes react with metallic sodium in the presence of anhydrous ether to form alkanes. This reaction is used for the proparation of higher alkanes. For example,

If we start with different alky handes, then a mixture of alkanes will be formed. For example, if we start with $CH_a I$ and $C_a H_a I$, a mixture of "there propage and makes will be formed.

64 Wurtz Fittig reaction

Halomanaes react with amparenes in the presence of sodium and in lydrous other to form alky benzenes.

66 Wolff-Kishner reduction

The reduction is done by heating the carbony compound with a mixture of hydrazine and KOH in the presence of hthylene glycot. It is called Wolff-Kishner reduction.

APPENDIX B

Distinction between Some Pairs of Organic Compounds (Chemical Tests)

 Chlorobenzene (C₀H₂Cl and Chlorocyclobexane Add a small quantity of aqueous KOH to each compound. Acidify with dil HNO₃ and add silver natrate solution.

Chinrocycloberane gives white ppt while chinrobenzene does not give this test

- 2. Chlorobenzene and Benzyl chloride. Same as 1. Benzyl chloride reacts with alcoholic AgNO, solution to give white ppt of AgCl while chlorobenzene does not give this test.
- 5. Ethyl chloride (C_2H_3Cl) and Vinyl chloride ($CR_2 = CHCl$). Ethyl chloride reacts with AgNO₂ solution to give white ppt of AgCl while vinyl chloride more not give this test.

$$CH_3CH_2C1 + AgNO_3 + AgC1$$
 $(white ppt)$
 $CH_2 = CHC1 + AgNO_3 \longrightarrow No ppt$

Carbon tetrachloride and Chloroform When chloroform is heated with an hine and alcoholic KOH solution, foul smell of isocyanide carbylamine is produced.

Carbon tetrachioride does not give this test

- 5. Chlorobenzene and n-Hexyl chloride Same as answer 1 n-Hexylchloride reacts with alcoholic AgNO₃ solution to give white ppt of AgCl while chlorobenzene does not give this test.
- 8. Chloroethane and Bromoethane Add a small amount of squeous KOH to each compound Acidify with d. HNO₃ and add a few drops of AgNO₃ solution. A white ppt, insolution in NH₄ JH. indicates chloroothane white aght yellow ppt, partially soluble in NH₄OH, indicates bromoethane.

7. 1, 1-Dichloroethane (gem dihalide) and 1, 2-Dichloroethane(Vie-dihalide) Add aquetus KOH solution to each compound, warm and add a few drops of 2, 4-dantropheny hydrazine 1, 1 Dichloroethane forms a yellow ppt while 1, 2-dichloroethane does not give the ppt

$$CH_3CHCi_2$$
 + 2KOH aq \rightarrow CH_3CHO + 2KC i + H_2O Acetaldebyde

Acetaldehyde gives yellow ppt with 2 4-th nitrophenyllydrazine

$$CH_0CHO + H_2NNH$$
 O_2 \rightarrow $CH_0CH = HNN$ O_2 \rightarrow NO_2 \rightarrow NO_2 \rightarrow NO_2 \rightarrow NO_2 Yellow ppt

1, 2-Dichloroethane forms ethylene glycol with aqueous KOH.

C·CH₂CH₂C + 2KOH eq → HOCH₂CH₂OH + 2KCl

Ethylene glycol

Ethylene glycol does not give ppt with 2, 4-directrophenyl hydrazine

- 8. 2-Bromopropene allyl bromide) and 1-Bromopropane (n.kyl bromide). Add a small amount of deblack MnO_4 solution. Becyer's reagent to each compound and shake \angle -Bromopropene $CH_2 = CHCH_2Br$ decolorises pink colour of $KMnO_4$ while \bot -bromopropane CH_2 \cap CH_2Br does not give \bot has test
- 9. o-Bromobenzyl chloride and o-Chlorobenzyl bromide o-Bromobenzyl chloride on shaking with aqueous NaOH and subsequent treatment with aqueous AgNO₃ press white precipitate of AgC. On the other hand, a-rhlorobenzy bromide on shaking with aqueous NoOH and subsequent treatmen with aqueous AgNO₃ produces dual yellow ppt of AgBr

10. a Propylchiaride and Isoprapyl chlaride. Isoprapy, chlands on alkaline hydrotysis with squeaus KOH gives isopropyl sicohol which gives vettow ppt with NaOf Todoform test. a Propyl sicohol on hydrolysis with aq. KOH gives a propyl a cohol which door not give todoform test.

laupnipyl chlonde

11. Methanol (CH₀OH and Ethanol (CH₀CH₂OH) Ethanol gives redeform test yetlow ppt of CHI₀ whereas methanol does not give hodoform test

12. Ethonol (CH₂CH₂OH) and Bonzyl alcohol (C₆H₅CH₂OH). Same as 11. Each out gives redeform test whereas benzyl alcohol does not give redeform test.

13. Ethanol (CH₂CH₂OH) and Phenol (C₄H₅OH)

- . Ethanol gives indoform test whereas phonoi does not give vellow pp. of oil iform (same as 11
- Phonor reacts with neutron FeCl₂ so when to give purpose on our whereas ether of does not give any colour with neutra. FoCl₂ solution.
- Phonor gives contained dye with the cold solution of between diagon up th order Ethanol does not give any dye

14. Phenol (CgH₅OH) and Cyclohexanol (CgH₁₁OH

- . Phonor gives violet colouration with neutra. FeCl, while eye obexalior does not give (same as 13).
- 44 Phenoi gives coloured dye with beazene character in or de whereas cyclohexago, does not .some as 13).
- Phenoi readily decolourises bromine water giving a white ppt of ₹ 4.6-tribromophenoi. But cyclohexanoi doub too.

 Propan-1-of (CH₃CH₂CH₂OH) and Propan-2-or (CH_{3/4}CHOH)]: Propan-2-or gives todoform test out propan-1-of does not vsame as 11).

$$CH_{g}$$

$$\begin{array}{cccc} CH_3 - CH - OU + 4U_0 + 6NaOH & \rightarrow & CHI_8 & + & CH_3COONa + 5NaI + 5H_2O \\ Propan & 2-m & lodeform & \end{array}$$

16. Butan 1 of and Butan-2-of Butan-2-of contains CH₂CHOH² group and gives verlow ppt, with NaOH, L₃ Indoform test. On the other hand, butan-2-of does not give yellow ppt, with NaOH L₂ Indoform test.

$$\begin{array}{cccc} \operatorname{CH}_5 & \operatorname{CH}_2 & \operatorname{CH}_2 & & & & & & & & & \\ \operatorname{CH}_5 & \operatorname{CH}_2 & & & & & & & & \\ \operatorname{CH}_5 & & & & & & & & & \\ \operatorname{CH}_5 & & & & & & & & \\ \operatorname{CH}_5 & & & & & & & & \\ \operatorname{CH}_5 & & & & & & & \\ \operatorname{CH}_5 & & & & & & & \\ \operatorname{CH}_5 & & & \\ \operatorname{CH}_5 & & & & \\ \operatorname{CH}_5 & & & \\$$

CH₂ CH₂ CH₂ CH₂ OH $\xrightarrow{\text{Natis}}$ No yellow ppt.

17. Propon-1-ol and 2-methylpropon-2-ol : 2-Methyl-propon-2-ol reacus with Lucius reagont prohyd ZnCl., • HCl. giving turbidity immediately

$$\begin{array}{ccccc} CH_0 & CH_0 & CH_0 \\ CH_0 - C \cdot OH & & \frac{Anhyu \; ZaCl_2}{All^{-1}} & CH_0 \cdot C \cdot C \\ \dot{C}H_0 & \dot{C}H_0 & \dot{C}H_0 \end{array}$$

Turbidity appears immediately

Propan Lor does not produce turbidity at room temperature with Lucas reagent

$$CH_3CH_2CH_3OH$$
 Anhyd Zar ϵ_3 No turbunty ϵ_4 room temperature

18. Formaldehyde and Acotaldehyde. Aceta dehyde gives yellow ppt of indoform with an alka, inc solution of induse (and form

Formaldehyde does not give this test.

19. Acetaldehyde (Proponal) and Acetone (Proponone)

Acetaid-byde gives silver mirror with Tollen's reagent.

Acetone does not give this test.

a) Acetaid-hyde gives red pp. with Fenling solution.

Febling solution

20. Benzaldehyde and Acetaldehyde Acetaldehyde gives yesow ppt with a time a kasme solution of sodine foodoform test, while benzaldehyde does not give ppt

Bonzardohyde does not give opt.

21. Benzaldebyde and Acetophenone

** Benzaldchydr forms suverm mor with animi macal at institute sociation. Tollen's reagent. Acetophenone does not react

$$C_8H_8CHO + 2|Ag NH_9|_9|OH + C_8H_8CONH_4 + 2Ag + dNH_3 + H_2O$$

Benezildehyde Tallen's reagent Silver nurvir

Acctophenone forms yellow ppt of todoform we walk-dire solution of todain and oform test. Benzaldehyde dues not back.

22. Pentan-3-one and Pentan-2-one

Pentan z-une forms yellow ppt with a liabline so stinu of indine rodoform test, but pentan-3-one does not give indoform test.

$$CH_{2}COCH_{2}CH_{2}CH_{3} + 3I_{2} + 4NaOH \rightarrow CH_{3}CH_{2}COON\theta + CHI_{3} + 3H_{2}O + 3NaI_{4}$$

**Pentan-2-one gives white ppc with sodium bisuiphite while pentan-3-one does not.

CH White opt.

OH

23. Acetophenone and Benzophenone Acetophenone gives yellow ppt with a kaline solution of indine todoform test. Benzophenone does not give this test.

$$C_gH_gCOCH_g$$
 $\xrightarrow{I_3, N_3OH}$ $CHI_3 + C_gH_gCOONg$
Acatophanone (Yallow ppt.)

24. Formue acid and Acetic acid

Formic soid gives silver mirror test with Tollen's reagent, whereas acctic soid does not give this test

$$HCOOH + 2|Ag'NH_{0/2}|OH \longrightarrow 2Ag + 2H_2O + CO_2 + 4NH_0$$

Formic and Totlen's reagent Silver

Formic acid gives white ppt with mercuric chionde solution

HCOOH + HgCl₁
$$\Rightarrow$$
 Hg₂Cl₂ + CO₂ + 2HCl
Forms and White ppt

Acetac acid does not give this test.

25. Acetic acid and Acetone

Acous pend reacts with NaHCO₃ to give effective scence due to evolution in CO₂: $CH_3COOR_- + N_BHCO_3 \qquad \Rightarrow \quad GH_3COON_8 + H_2O + CO_3^\top$

Acetic seid

Acotone does not give effervescence with NaHCOn.

a Acctone reacts when a kanne solution of adam to give yellow ppt due to indoform tost. Acctic and does not give test.

m. Accome also gives brange coloured ppt with 2. 4-dinitrophenyl hydraxing while icolar acid does not

26. Phenol and Benzoic acid

m Benzoic acid reacts with NaHCO $_3$ to give effervencence due to the evolution of ${
m CO}_2$.

C₆H₆COOH + N_BHCO₃ → C₈H₆COONa + L₂O + CO₂ Benzorc and

Dellevic delle

Phenol does not give effervescence.

ii) Phenot gives violet colour with FeCl₃ solution but benzoic acid does not give such colour

27. Phenol and Acetic acid

. Accur acid reacts with NaHCO3 to give effervescence a n to the evolution of CO_3 : $CH_3COOH + NaHCO_3 \longrightarrow CH_3COONa + CO_3 + H_3O$

Phenol does not give effervescence

CeHaOH + NaHCO No reaction

Phenol gives violet colour with FeCl_g but acetic said gives buff coloured ppt.

 $3C_6H_6OH + FeCl_5$ \rightarrow $(C_6H_6O)_3Fe + 3HCl_5$ Veolat $3CH_3COOH + FeCl_4$ \longrightarrow $(CH_3COO)_3Fe + 3HCl_5$ Baffoot

28. Ethonol and Acetic acid

Ethanol does not give effervoscence with NaHCO₀.

uv Ethanol gives verlow ppt with a kanne solution of Ly odularm test; while acetic acid does not give this test

29. Ethyl cyanide and Ethyl isocyanide

Ethyl cyanide on hydrolysis with acids gives proptome acid.

CH₂CH₂CN H¹ H₂ → CH₂CH₂COOH Ethyl cyanods Propiotic soid

On the other hand, othy- isocyanide with du HCl gives ethy- amine and formic and

 $CH_{\gamma}CH_{\gamma}NC$ $\xrightarrow{H_{2}^{\dagger}$, H^{\ast} $CH_{\gamma}CH_{\gamma}NH_{\gamma} + HCOOH$ Ethy amos Formic acid

er Ethy cyanide on reduction with hydrogen in the presence of No or Pt gives primary amine while ethylisocyanide gives secondary amine

 $\begin{array}{cccc} CH_{2}CH_{2}CN & \xrightarrow{H_{2}, M_{3}} & CH_{2}CH_{2}CH_{2}NH_{2} \\ Ethyl cyanuda & 1^{\circ} armine \\ CH_{2}CH_{*}NC & \xrightarrow{M_{2}, M_{3}} & CH_{3}CH_{2} & NH_{*}CH_{3} \\ Ethyl cyanuda & & & & & & & & \\ \end{array}$

30. Nitroothane and Ethylmstrite

No roethane in reduction with H/Ni gives primary totales while nature gives primary alcohol

Ethy intrite on hydrocysis form account while natruethane does not get hydrocysed.

$$C_0H_0-O-N=O+NaOH$$
 $\xrightarrow{Haderless}$ $C_0H_0OH+NaNO_2$
Etherion
$$CH_0CH_2NO_0+NaOH$$
 \Rightarrow Not hydrotysed

31. Ethylamine and Anthine Azo dye test. Dissoive the compound in conc. In C. and add ice-cold solution of HNO., NaNO., + d: HC and then treat it with an a ketine solution of 2 haphtho: Appearance of bir hant orange or red dye indicates and inc.

1 Phenytozo-2-naphthní (Orange red dye

Ethylamine does not form dye. It will give brisk effervescence due to the evolution of N_2 but solution remains clear

32. Ethylemine and Diethylamine

 Corbylamine test. When heated with an acohour solution of KOH and CHCl₃, ethylamine gives four smell of ethyl isocyanide

$$CH_3CH_*NH_4$$
 $CHCl_3 + 3KOH$ \Rightarrow CH_3CH_*NC $+ 5KCl + 3H_*O$
Ethytomine are Ethytosocyanide
Foot smet

Diethylamine does not give the test.

a Hinsberg's test. When treated with Hinsberg's reagent "benzene an phony, chlonde G_gH_gSO_gC_g, ethylam ne gives N-ethyl benzene an phonom de which is soluble in eq. KOH solution.

Diethylam as gives N. N-desthyl benzene sulphonamide which is insoluble in aqueous KOH



Organic Conversions

ORGANIC CONVERSIONS AND ROAD MAPS FOR ORGANIC CONVERSIONS

Organic conversions are very important part of study of organic channeling. They provide very interesting intertink between different reactions and involve thorough understanding and skill to apply the reactions. Only practice and memory can induce confidence for attempting the conversions. Some basic road maps or memory aids are given in this appendix.

Basic tips

- . The route selected for the conversions should be the shortest possible
- On with proper reagents must be used in different reactions. These are generally written on the arrow

ALIPHATIC CONVERSIONS

The conversions may be divided into three types

- 1 Ascent of series. These involve the conversion of an organic compound into new higher nomotogiae. Therefore, carbon stom is introduced in the chair.
- Descent of series. These involve the conversion of an arganic compound into its next lower homologue.
 Therefore, a carbon atom is removed from the chain.
 - 3. Simple conversions. These in whice general convers was from the family of compounds to another
 - 1 Conversions based on ascent series
 - (a) By Wurtz reaction. These involve conversion from lower hydrocarbon to higher hydrocarbon.

For example,

(f) Methane to ethane

(ii) Ethane to butane

$$CH_3CH_3$$
 $\xrightarrow{CH_3CH_3CH_3}$ $CH_3CH_3CH_3CH_3$
 $CH_3CH_3CH_3CH_3$

But, if we wish to prepare propage from ethoge, the reaction is

$$CH_0CH_3$$
 CH_3CH_2CI $CH_3CH_3CH_3$ $CH_3CH_3CH_3$ $CH_3CH_3CH_3$ $CH_3CH_3CH_3$

However this is not a good method because in addition to propane, ethane and butane will also be formed by the reaction of ethyl chioride and methyl thloride.

(b) Through cyanide. This is an important method for ascending the series. The basic reaction in these conversions is

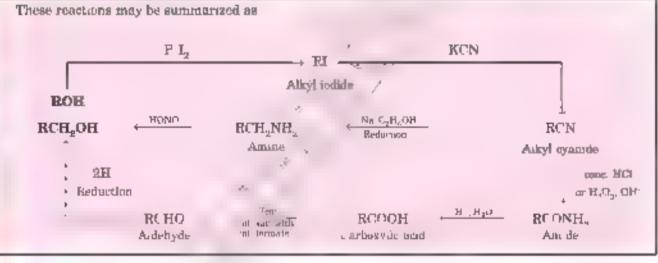
The alkyl cyamide has one carbon atom more than the alkyl halides. This can be directly converted into other compounds through cartain steps.

RCH_CI

Alkyl balide

hoct,

Alembol





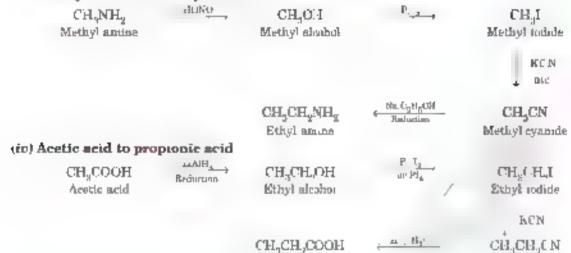
Navarcohor (Recordant) BUNO CH,CH,OH CH,CH,NH, (Stanto, ABOI) Ethyt alcohol: Ethyl amine

(ii) Ethyl lodide to propyl iodide

HCN rale No. vallett CH_nCH_nI CH_CH_CN CH₀CH₂CH₂NH₂ Ethyl iodide Ethyl cynnide Реору ввиве HONO P, I CH_CH_CH_I CH,CH,CH,OH Propyl todida Propyl edrolon.

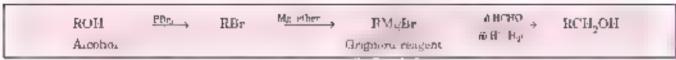
Ethyl cyanide

(iii) Methyl amine into ethyl amine



(c) Through Grignard reagent. This route is followed for inverting lower alcohol. ROH to a higher alcohol through the formation of Grignard reagent.

Proportic acid



By using different a dehyacs or Grignard reagents to flere, a products can be obtained.

The main reaction in these is an reaction of an aidrhydrow this Grignard reagent deflowed by hydrolysis to give alcohols.

The reaction may be written as



For example,

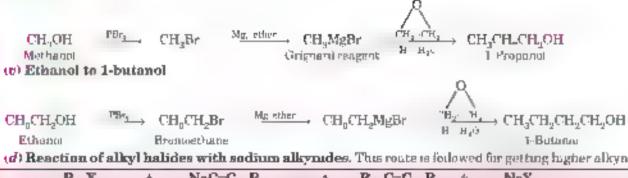
(i) Methanol to ethanol

(ii) Methanol to Propon-2-ol

(lil) Methanal to ethanal

D

(te) Methanel to 1-propanel



(d) Reaction of alkyl halides with sodium alkynides. This route is followed for getting higher alkynes

R—X	-	NaC=C—R	- 4	R—C=C—R	4	NaX	
Autyl belide		and, olkymide		higher alkyno			

Sodium alkymdes needed for the above purpose are formed by the reaction of sodamide with alkynes containing triple bond.

$$H-C=C-R$$
 + $NaNH_2$ + $NaC=C-R$ + NH_3

For example,

Methane to propone

$$\begin{array}{cccccccc} \mathrm{CH}_4 & \xrightarrow{\mathrm{ET}_{g_1,h_2}} & \mathrm{CH}_g\mathrm{CI} & \xrightarrow{\mathsf{N}_0\mathrm{CreCH}} & \mathrm{CLI}_g\mathrm{C} = \mathrm{CH} & \xrightarrow{\mathsf{H}_g^{-N_1}} & \mathrm{CH}_g\mathrm{CH}_$$

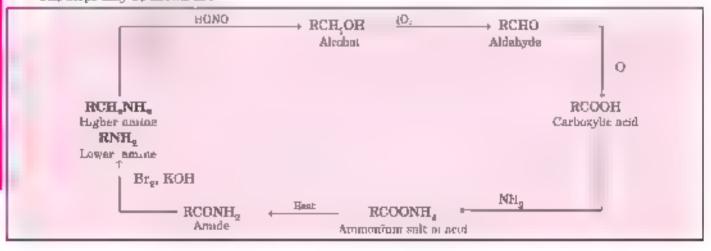
(ii) Acetylene to hut-1-yne

(iii) Mothanol to propanone

2. Conversions based on descent series

(a) Through Hoffmann's bromamide reaction. The case reaction in these conversions is thrown as Hoffmann's bromamide reaction;

The amine formed has one carbon atom less than the parent amide The steps may be shown as .



For example.

(i) Ethyl alcohol to methyl alcohol

(i) Ethylamine to methylamine

CH₃NH₂ ← Bc, ROR CH₃CONH₂ ← CH₃COONH₄ ← CH₃COOH Aceta and Aceta acid

(iii) Acetic acid to formic acid

HCOOH CHanna HCHO Chadadan HaoH CHaNHa CHaNHa Methyl ancine

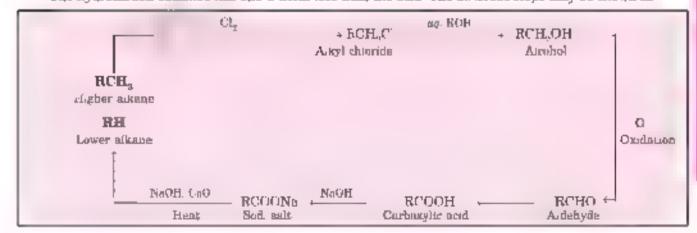
(iv) Ethyl iodide to methyl iodide

NH₂, Heat

(b) Through decarboxylation of a fatty acid with sodalime NaOH + CaO. The basic reaction in these conversions is

RCOONs NoOH, CaO 4 RH

The hydrocarbon obtained has one C-atom less than the acid. The different steps may be shown as



For example

. Propionic acid to ethane

 $CH_{\eta}CH_{\zeta}COOH$ $\xrightarrow{M_{0}CH_{0}}$ $CH_{\eta}CH_{\zeta}COONa$ $\xrightarrow{CaO.N_{0}OH}$ $CH_{\eta}CH_{3}$ Propions acid Ethane

a Acetylene to methane

(c) Simple conversions. These conversions are based upon chemical reactions of various substances below the book discussed during the study of a flerent functional groups. Chapters 8 to 10 to Some common road maps involving different conversions are given below.

Road map 1

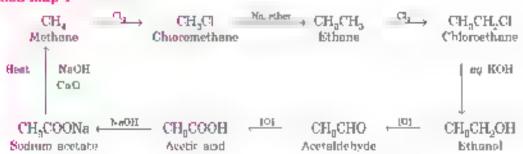
Road map 2

Bond map 3

$$HC = CH$$
 $\xrightarrow{H^{-}H_{2}O}$
 $H_{0}CHO$
 \xrightarrow{iOI}
 $CH_{0}COOH$
 $C^{*}CO_{2}$
 $CH_{0}COO_{2}$
 $CH_{0}COO_{2}$
 $Coldium$ acetate

Heat

Road map 4



Road map 5

Road map 6

Road map 7

Rond map 8

Road map 9

OH

$$CH_{3} \leftarrow H$$
Acetnidehyde

$$CH_{3} \leftarrow CH_{3} $

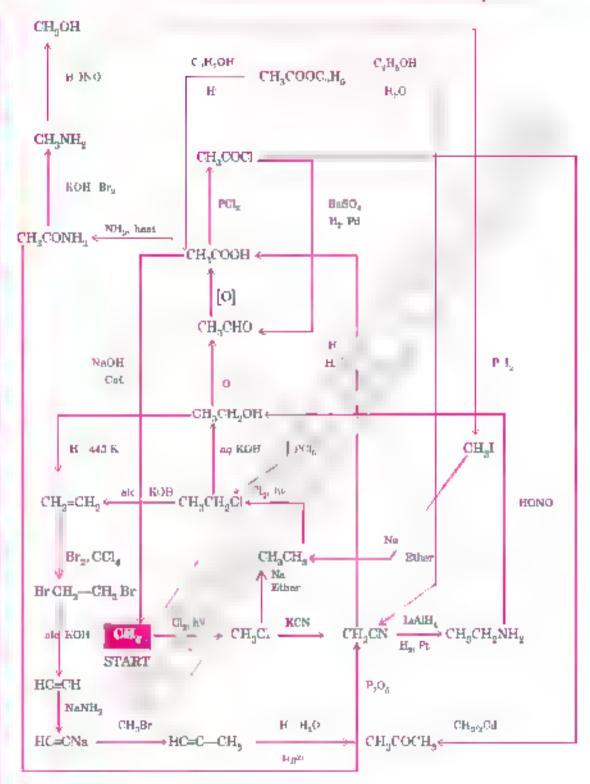
NaOH HOHO

$$HOCH_2$$
 CH_2CHO $\xrightarrow{H^+, H_{peak}}$ $CH_2 = CHCHO$ \xrightarrow{BLN} $CH_2 = CH-CH-CN$ $\xrightarrow{H^+, H_{2^{-1}}}$ OH

CH⁸=CH - CHCOOH

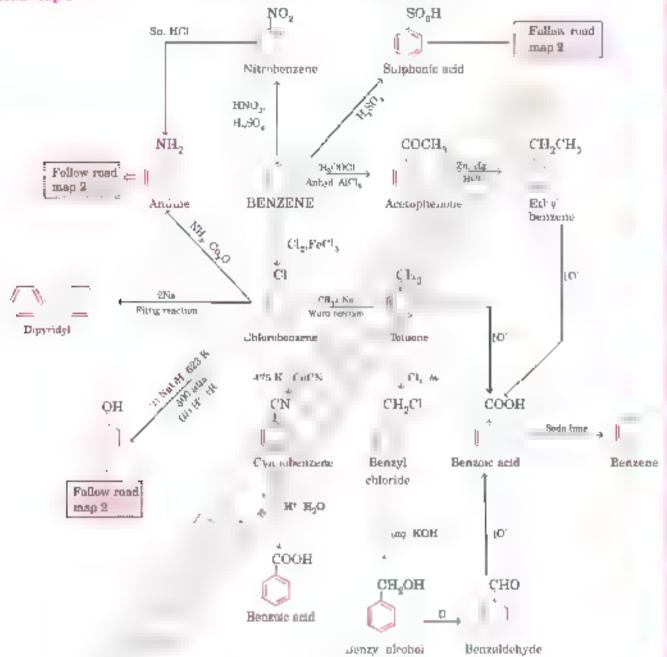
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Summary of Routes ATLAS OF BASIC ORGANIC CONVERSIONS Auphanic

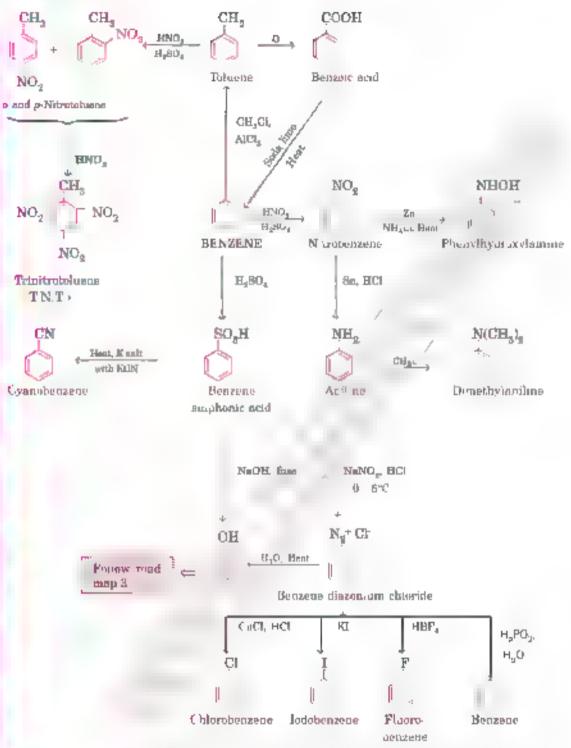


AROMATIC CONVERSIONS

These are based upon the general reactions of different substances. Some common road maps are Road Map 1.

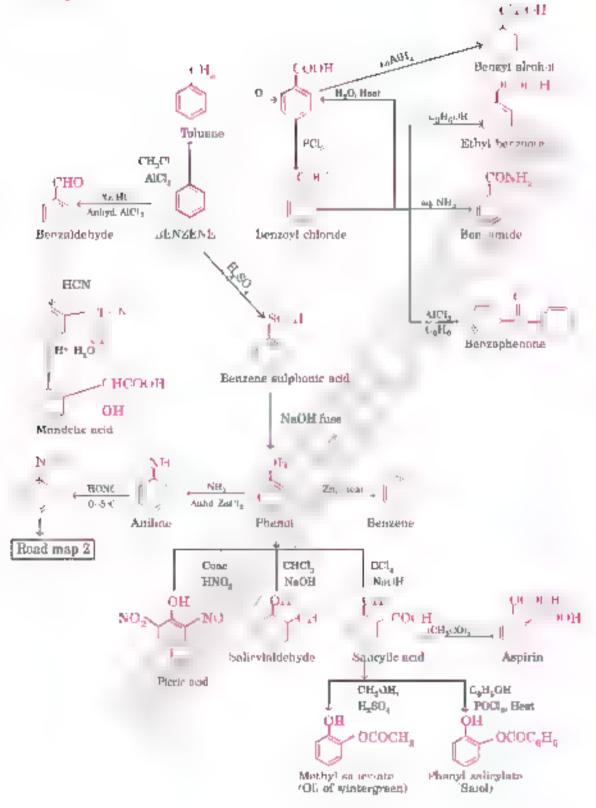


Road Map 2



The different examples are a ready discussed in Chapters 8-9 and 10

Road Map 3.



SOME TYPICAL CONVERSIONS

1 Ethanal to ethanedial (ethylene glycol)

$$\begin{array}{ccccc} CH_{2}CH_{2}OH & \xrightarrow{Com_{1}H_{2}90_{1}} & CH_{2} = CH_{2} & \xrightarrow{alk~EMoO_{2}} & CH_{2} & CH_{2} \\ & & & & & & & & \\ Ethanol & & & & & & & \\ & & & & & & & \\ & & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & & \\ & & & \\ &$$

2. Ethylidene dichloride to ethylene dichloride

3. Ethyl alcohol to vinyl acetale

4. Acetylene to lactic acid

5. Acetylene to acetone

6. Prop-2-enal to 2,3-dihydroxypropanal

CH. • CHCHO

$$C_{\mu}H_{\mu} \circ H_{\mu} \circ H_$$

7. Ethanul to 2-hydroxy-3-butenote acid

CH, CHO

Belianes

$$H_2C = CH - CH$$

CH COOH

 $H_2C = CH - CH$

OH

OH

8. Ethanoic acid to a mixture of methanoic acid and diphenyl ketone

9. n-Propyl alcohol to isopropyl alcohol

10. Acetonitrite to mesitylene

CH, CN

 $H^{2O/B_s} \rightarrow CH^3COOH \xrightarrow{Cu(OH)^3} (CH^0COO)^2Ca$

11 Propene to ethyne

12. Butanone to 3, 4-dunethythexune

13. Ethylene to succinic acid

$$H_1C = CH_2 + CL_1 \xrightarrow{h} + CICH_{n'} + CH_2CI \xrightarrow{\text{old}} & \text{REN} \\ \text{Ethylene} & \text{Ethylene dichloride} & CN_1CN_2 & CH_2COOH_2 \\ \text{Stemmic decide} & CN_1COOH_2C$$

14. Methyl alcohal to ethylene glycol

Sinciple and

3-Chiopoliutarion acid

15. Acetic acid to succinic acid

16. Acetic acid to glycine

$$\begin{array}{cccc} CH_{2}COOH & \stackrel{P_{1} \times I_{2}}{\longrightarrow} CH_{2}COOH & \stackrel{NH_{1}}{\longrightarrow} & CH_{2}COOH \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & & \\ & & \\ & & & \\ & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ & & \\ &$$

17 Acetic word to acetaldehyde

18. Propanoic acid to Propan-2-ol

19.2 Chlorobutanoic acid to 3-chlorobutanoic acid



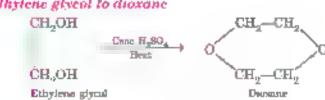
20. Propan 1-ol to 1-chloro-propan 2-ol

21 in Heynne actrile to Famous propane

22. Acetaldehyde to malanic acid

29. Propanone to mexityl oxide

24. Ethylene givent to dioxane



25. Propunole acid to lactle acid

$$\begin{array}{cccc} CH_3CH_2COOH & \stackrel{P_1B_2}{\longrightarrow} CH_3CHCOOH & \stackrel{\text{rej. babb.}}{\longrightarrow} CH_3CHCOOH \\ & & OH \\ & & \text{propagator acid} & & \\ \end{array}$$

26. Ethylene to tartaric acid

27 Ethylene to butan 2-one

28. Acette acid to acetonitrile

29 Propannie acid to verybe acid

$$\begin{array}{c} \mathrm{CH_2CH_2COOH} & \xrightarrow{\mathrm{Br}_2 \cdot \mathrm{P}} & \mathrm{CH_2CHCOOH} & \xrightarrow{\mathrm{ak} \ \mathrm{KOH}} & \mathrm{CH_2 \circ CHCOOK} & \xrightarrow{\mathrm{R}_2 \circ \mathrm{CH}} & \mathrm{CH_2 \circ CHCOOH} \\ \text{Proposods nodd} & & & & & & \\ \mathrm{Br} & & & & & & \\ \end{array}$$

30. Methyl chloride to chloro acetic acid

31. Aceta acid to propunoic acid

32. Acctaidehyde to acctamide

$$CH_0CHO \xrightarrow{R_1 R_2 R_3} CH_0COOH \xrightarrow{Strong} CH_0COCI \xrightarrow{R_{R_2}} CH_0CONH_2$$

Aperturbed Apprturbed Apprturbed Aperturbed Aperturbed Apprturbed
33. n-Propyl branade to ethylamine

$$\begin{array}{ccc} \mathbf{CH_{g}CH_{g}CH_{g}Lr} & \xrightarrow{\mathrm{eq} - \mathrm{He} \mathrm{e} \mathrm{e}} & \mathbf{CH_{g}CH_{g}CH_{g}OH} & \xrightarrow{\mathrm{fig. 6} \mathrm{e} \mathrm{e}} & \mathbf{CH_{g}CH_{g}OH} \\ \mathbf{n}\text{-Propyl bromide} & & \mathbf{SOCI_{g}} \end{array}$$

34. Acetamide to propionamide

CH₂CONH₂ → CH₃COOH LAN ← CH₂CH₄OH → CH₃CH₄D

CH₃CH₉CONH₂ + Partial CH₃CH₉CN
Propionamide

35. Acetylene to chloroform

36. Formie acid to glycolle acid

37 Propanal to 3-methyl-3-pentonol

CH₃ CH₄

CH₂CH₂CHO dll NaOH → CH₃CH₂CHCH₂CHO H → CH₃CH₂CH=C ← CHO NaH → CH₃CH₂CH=C ← CH₂OH

Propana.

OH

CH

"Meltryl pen, 2-engl

38. Acetaldehyde to acetoacetic ester

CH₂CHO ← CH₂COOH → CH₂COOH → CH₂COOL₂H₅ ← Ch₂COCH₂COOC₂H₅ ← Ch₂COCH₂COOC₂H₅ ← Contain the Contain

39. $CH_3CH_3C = CH$ $\Rightarrow CH_3CH_3CH_3COCH_3$ three steps,

 $CH_3CH_2C = CH \xrightarrow{KaNH_2} CH_3CH_2C = CNa \xrightarrow{CH_3} + CH_3CH_2C = C - CH_3 \xrightarrow{H_2^{D^*}, H} + CH_3CH_2COCH_3$

Br

40. Pent 1-ene to Pent 2-yne

CH₃ • CHCH₃CH₄CH₃ • CH₃CHCH₄CH₂CH₃ • de KOH →

Portes one

Br

CH₃C = CCH₄CH₃ ← de EdB CH₃CH CHCH₄CH₃ ← CH₃CH•CHCH₂CH₃ ←

Pent-2 vne

41. Toluene to 1. d, 5-trinitrobenzene

 $\begin{array}{c} \text{CH}_8 \\ + 2 \text{ HNO} \\ \text{Reson} \\ \text{NO}_2 \\ \end{array} \xrightarrow{\text{NO}_2} \begin{array}{c} \text{COOH} \\ \text{NO}_2 \\ \text{Such time} \\ \text{O}_2 \text{N} \\ \end{array} \xrightarrow{\text{NO}_2} \begin{array}{c} \text{COOH} \\ \text{NO}_2 \\ \text{Such time} \\ \text{O}_2 \text{N} \\ \end{array}$

Br

42 Totaene to o-cresol

$$\begin{array}{c} CH_{8} & CH_{3} \\ & HNU_{2} \\ & U_{2}SU_{4} \end{array} \rightarrow \begin{array}{c} CH_{3} \\ & NO_{2} \\ & N_{2}CI \end{array} \rightarrow \begin{array}{c} CH_{3} \\ & N_{2}CI \end{array} \rightarrow \begin{array}{c} CH_{3} \\ & N_{2}CI \end{array} \rightarrow \begin{array}{c} CH_{3} \\ & OH \end{array}$$

a lo. 5-Transpobensene

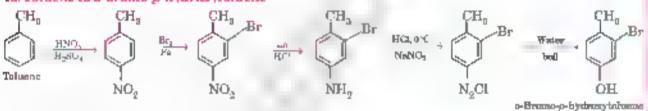
37

48. Toluene to in cresol

$$\begin{array}{c} CH_3 \\ \hline \\ Ditagne \end{array} \xrightarrow{\text{ENU}_3 \cdot \text{Basio}_3} \xrightarrow{\text{CH}_3} \begin{array}{c} CH_3 \\ \hline \\ NO_2 \end{array} \xrightarrow{\text{ENU}_3 \cdot \text{CH}_3 \cap \text{OSO}} \xrightarrow{\text{CH}_3 \cap \text{OSO}} \begin{array}{c} CH_3 \\ \hline \\ NHCOCH_3 \end{array} \xrightarrow{\text{NHCOCH}_3} \begin{array}{c} CH_3 \\ \hline \\ NHCOCH_3 \end{array}$$

44. Toluene to 3-netro-4-bromobenzote acid

45. Toluene to o-bramo-p-hydroxytoluene

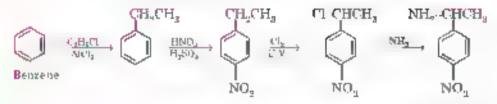


46. Benzaldehyde to cyanobenzene

47 Benzene to m-chlorotoluene

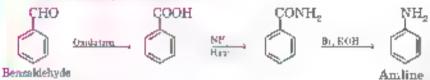
48. p-Nitroandine to a 4,3-tribromobenzene

49. Benzene to a-(p-nitrophenyl) ethylamine

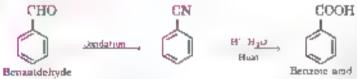


ti-tp-nitrophenyl athylamine

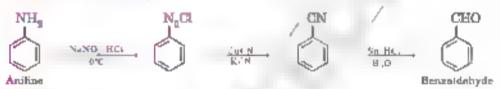
50. Benzaldehyde to antline



51. Benzatdehyde to benzoic acid



52. Ansline to benzuldehyde

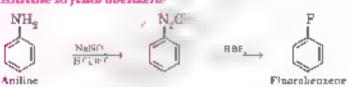


53. Aniline to phenyl hydraxine

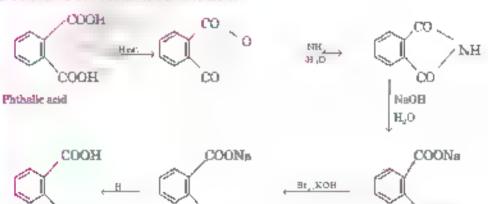


64. Aniline to fluorobensene

Andersolle and



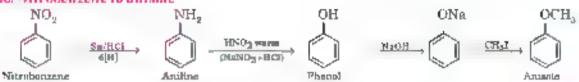
55. Phthalic acid to anthrombe acid



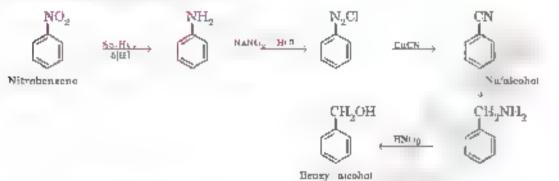
CONH,

NH.,

56. Nitrobenzene to anisale



57 Nitrobenzene to benzyl alcohol



68. Benzene aulphonie sold to benzylamine



Deozene sulphimie and

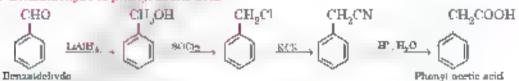
59. Benzoic acid to andline



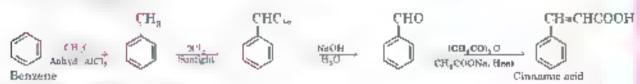
60. And one to benzylumine



61 Benzaldehyde to phenyl acetic acid



62 Benzene to emanue acid



63. Benzene to sulteville used

64. Bromobenzene to m-nitrobenzole actd

65. Anthre to beneate weld

66. Acetaldehyde to dimethyl phenyl carbinol

$$\begin{array}{c} \text{OH} \\ \text{CH}_{0}\text{CHO} \xrightarrow{[O]} \text{CH}_{0}\text{COOH} \xrightarrow{\text{Cworley}} \text{CH}_{1}\text{COO}_{2}\text{Ca} \xrightarrow{\text{Diverbelow}} \text{CH}_{2} \xrightarrow{\text{C}} \text{CH}_{2} \xrightarrow{\text{C}} \text{CH}_{3} \xrightarrow{\text{CallyMags}} \text{CH}_{3} \xrightarrow{\text{C}} \text{CH}_{5} \\ \text{Accessaride by de} \\ \end{array}$$

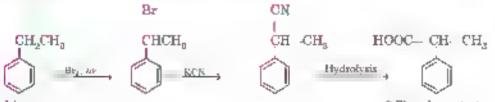
67 Benzene to m-dichlorobenzene

Benzene
$$\begin{array}{c} \text{NO}_{e} \\ \text{H}_{y}, \phi_{x} \\ \text{H}_{y} & \phi_{x} \\ \text{H}_{y} \\ \text{H}_{y} & \phi_{x} \\ \text{H}_{y} \\ \text{H}_{y} & \phi_{x} \\ \text{H}_{y} \\ \text$$

68. Benzene to 4 mtrobenzaldeh de

69. Benzene sulphonic acid to m methacyani ine

70. Ethyl bensene to 2-phenyl propionic webl



Ethyl banzene 2-Phenyl propionic acid

APPENDIX D

Problems based upon Organic Reactions

• Compound A ← In (Creacts rapidly with sodium metal but undergoes or reaction with Lucas respect or name through the first with the property of the first throughout the first with the property with the property of the first with the

Ans A = 3 Mathyapropan in B = 2-Me by propens C = 4-Methy propan out

2. A kettors: A which gives appoint on the firm on the acting gives a reported. The empound on he may with conc. ILSO, gives a compound to which forms mone oxonide. The drewn post into this mone oxon degives only acetaldohyde. Identify: A), (B) and (C).

Any A syntholdred, B substitution of the the Oleh

OH

3 Compound A 1 H 1 forms a derived se with hims and give veryow apt with one or and sugarm by decide solution. If does not react with T then a reaging W and is its surrecture of A.

Ans. Protan-2-one

4 Comprand Art H O or hemong with aqueous send forms a carboxyae acid B and an alcohol to Cook to add had hM of good B Win to be set that a d A B and t

Ans A so Poss properties B. Properties of Posser Lab

5. An optical, active number A is 11 NO on and hydrogony we are acid and ammoria. When A is treated we hopping a reliable near partial active a cohol and distrogen. The arrobin gives post we are dorm sess. What is the structure to A and show the reactions involved?

Ana. A is 2-methy/hutansmide

6. A compound having to decutar formula fig. [1] Forms crystalline white peer putate with sodium hisulph to and gives a red precipitate with Fibring solution. Write structural formula cumulan name and His Atname of the compound. Also give equations for the above reactions.

Ang. CH_CH_CHO, Proponaldehyde, Propagal.

7 Compound A C.1 Compound to be served plate with phones hadrazine. Chodation of A with h. C. of gives B. C.1 O Compound to be served a with phonel hadrazine but dises not give I not be test. The unposal compound A can be decreased to be supplied as a disease shade carbon C. C. L. Ozoni see of the hadrocarbon C. gives noted by and acetaldrhyde. Deduce the structural formular of A. B. and C.

Ans A CH CH CH CH B C CH C CH C CH. C- HCH.

- 8 An argument period of 1.1.) a result pitting a coping formula compound B t H O is reduction which calls with HBs in formula before it. I formula only and make out which reacts with A tigate D t_aH = 1 times in the result A B t and D and a part the tractions.
- 9 At reach costs, and (A) H () reaches with HI giving a compound B . H I will on reduction gives a to man hadr cortion having four eartion atoms. On exidation A gives compound to I d and their plants at 1 L(1). Deduce the structures of A B () and D

Ana. A) $=C_1H_1OH:$ $+B_2=C_2H_1L_2CCC_2H_2CHO:$ $+D_2C_2H_2COOH$

(1) As argument many in A introduction with the agent of gives corbinate a principle of the first and a corbinate of the agent of the a

Ans A = CH(O) B = CH(O)B of A = CH(O)B B = CH(O)B

11 Composite A 1, H. Cundergoes with an Cycle B 1, H. D. B. formus in which the sort gray Table is that B marks with on the air, potassium by an order is give modern. Dec. to the structures of A one B and show reactions.

Ans. A: Batan-2-ol. (B. 2-Botan one

 \mathbf{E}

1

 ${f E}$

12. An organic compound (A) on treatment with acetic acid in the presence of sulphuric acid produces an ester (B). (A) on mild exidation gives (C). (C) with 50% potassium hydroxide followed by acidification with dilute hydrochloric acid generates (A) and (D). (D) when treated with phosphorus pentachloride followed by reaction with ammonia gives (E).(E) on dehydration produces hydrocyanic acid. Identify the compounds A, B, C, D and E.

Ans. (A) CH,OH (B) CH,COOCH, (C) HCHO (D) HCOOH (E) HCONH,

13. An organic compound C_aH_aN (A) on heating with calculated quantity of methyl iodide gives C_aH_aN (B) which reacts with HNO_a to form C_aH_aN_aO (C). Hydrochloride of (B) on heating isomerises to another compounds (D), Compound (C) on heating with hydrochloric acid regenerates (B), Identify (A), (B), (C) and (D).

Ans. (A) (B) (C) (D) (D) (CH,

14. An organic compound A (C_nH_zN) on boiling with alkali gives ammonia and sodium salt of an acid (C_nH_zO_y).
Upon reduction, A gives C (C_nH_zN) which upon treatment with nitroos acid gives D. Deduce the formulae of the compounds A, B, C and D.

Ans. (A) CH,CH,CN (B) CB,CH,COON6 (C) CH,CH,CH,NH, (D) CH,CH,CH,CH

15. A compound (A) C_sH₁₀O liberates hydrogen gas with sodium metal. A does not react with sodium hydroxide and gives a positive Lucas test immediately. When A is treated with PBr_s, compound B is formed (C_sH₁₀Br). When B is treated with alcoholic KCH, compound C and D, both having formula C_sH₁₀ are formed. C is a major product while D is a minor product. When C is treated with ozone followed by hydrolysis, only single ketone is formed. The ketone can be shown to be identical with the compound produced by hydration of propyne in the presence of sulphuric acid and Hg²¹. Deduce the structural formulae of the compound A, B, C and D.

Ana. (A) (CH₂)₂CH—C(CH₂)₃
(B) (CH₁)₂CHC(CH₂)₃
(C) (CH₂)₂C=C(CH₃)₃
(D) (CH₃)₂C+CH=CH₃
(CH₃)₃C+CH=CH₃
(CH₃)₄C+CH=CH₃
(CH₃)₅C+CH₅
(CH₃)₅CH—CH=CH₃
(CH₃)₅CH—CH=CH=CH₃
(CH₃)₅CH—CH=CH₃

16. Compound A $(C_aH_{ic}O_a)$ on reduction with LiAlH, yielded two compounds (B) and (C). The compound (B) on oxidation gave (D) which upon treatment with aqueous alkali and subsequent heating furnished (E). The latter, on catalytic hydrogenation, gave (C). The compound (D) was oxidised further to give (F) which was found to be monobasic said (Molecular weight = 60), Deduce the structures of (A), (B), (C), (D) and (E).

Ans. (A) CH₂CH₂CH₂COCH₂CH₃ (B) CH₂CH₂OH (C) CH₂CH₂CH₂CH₂OH (D) CH₂CHO (E) CH₂CH = CHCHO

17. Give the structure of (A), (B), (C) and (D)

- Compound (A), C,H,N reacts with benzene sulphonyl chloride to give a solid insoluble in alkali.
- (ii) Compound (B), C_iΩ_i which adds on BBr in the presence and absence of peroxide to give the same product.
- (iii) Compound (C) C,H_g, which when treated with H₂SO,/H₂O gives C,H₃₀O which cannot be resolved into optical isomers.
- (iv) Compound D, C_aH_{ij}, an optically active hydrocarbon which on catalytic hydrogenation gives an optically inactive compound.

Ans. (A) Ethylmethylamino (B) But-2-ene (C) trans-But-2-ene (D) 3-Methylpent-1-ene.

18. An optically active alcohol (C_aH₁₀O) absorbs two moles of hydrogen per mole of A upon catalytic hydrogenation and gives a product B. The compound B is resistant to oxidation by CrO_a and does not show any optical activity. Deduce the structure of A and B.

D

D

19. An organic compound (A) composed of C, H and O gives characteristic colour with ceric ammonium nitrate. Treatment of (A) with PCI₈ gives (B) which reacts with KCN to form (C). The reduction of (C) with warm Na/C₂H₅OH produces (D) which on heating gives (E) with evolution of ammonia. Pyridine is obtained on treatment of (E) with nitrobonzene. Give structures of (A) to (E) with proper reasoning.

Ans. (A) HOCH, CH, CH, OH (B) CICH, CH, CH, CH

(D) H,NCH,CH,CH,CH,CH,NH,

(E) (N

(C) NCCH_CH_CH_CH_CN

20. An aromatic compound (A), C,H,Br reacts with H C(COOC,H.) in the presence of C,H,ONs to give (B). Compound (B) on reflexing with dil H,SO, gives (C) which on vigorous exidation gives (D). The compound (D) is dibasic but on heating does not give an anhydride. It forms a mononitro derivative (E), in which all the substituents are equidistant from one another. Give structures of (A) to (E) with proper reasoning.

21. Compound (A), C₁₀H₁₂O gives off hydrogen on treatment with sodium metal and also decolourises Br₂ in CCl₄ to give (B), C₁₀H₁₂O Br₂, (A) on treatment with L₂, NaOH gives indoform and an acid (C) after addification, Give structures (A) to (C) and also all the geometrical and optical isomers of (A).

22. An organic acid (A), C_sH_mO_s reacts with Br_s in the presence of phosphorus to give (B). Compound (B) contains an asymmetric carbon atom and yields (C) or dehydro bromination. Compound (C) does not show geometrical isomerism and on decarboxylation gives an alkene (D) which upon ozonolysis gives (E) and (F). Compound (F) gives positive Schiff's test but (F) does not. Give structures of (A) to (F).

 \mathbf{P}

 \mathbf{P}

 \mathbf{E}

N

D

1

C

 \mathbf{E}

S

23. An organic compound (A) C_nH_nO_n on heating with sodalime gives (B), which reacts with HCN to give (C). The compound (C) reacts with thionyl chloride to produce (D) which on reaction with KCN gives compound (E), Alkaline hydrolysis of (E) gives a salt (F) which on heating with sodalime produces n-butane, Careful oxidation of (A) with dichromate gives acetic acid and malonic acid. Give structures of (A) to (F).

24. Compound (A) (C,H,O) on treatment with NH,OH, HCl gives B and C. B and C rearrange to D and E, respectively, on treatment with acid. B, C, D and E are all isomers of molecular formula (C,H,NO). When D is builed with alcoholic KOH, an oil F(C,H,N) separates out, F rearts readily with CH,COCl to give back D, On the other hand, E on boiling with alkali followed by acidification gives a white solid G(C,H,O₂). Identify A to G.

Ans.
$$C_gH_gCOCH_g \xrightarrow{RE_gCH} C_gH_g$$

$$C_gH_g COCH_g \xrightarrow{RE_gCH} C_gH_g CONHCH_g H_g$$

$$C_gH_g COCH_g \xrightarrow{R^*} C_gH_gCONHCH_g \xrightarrow{R^*} C_gH_gCOOH$$

$$C_gH_g COCH_g CGH_g CGH_g CGH_g CGH_g CGH_g CGH_g CGH_g CGGH_g C$$





About the Book

The book in your hands is strictly based upon the syllabi prescribed by C.B.S.E., New Delhi and Educational Boards of other Indian states. It has been written according to N.C.E.R.T. pattern keeping in view the changing trends of different examinations. Thus this book has been very popular among the teachers and students all over India and praised for its clear presentation, effective approach of solving numerical problems and attractive figures.

KEY FEATURES OF THE BOOK ARE

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